

revision B



445 power oscillator



19535 EAST WALNUT DRIVE • CITY OF INDUSTRY, CA. 91748

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SECTION I

INTRODUCTION

This manual contains operation and maintenance instructions for the AILTECH 445 Power Oscillator, using the Model 183, 184, 185, 186, 187, 188A, and 189A plug-in modules. Section III explains the basic theory of operation. Section IV is a complete circuit description. Section V has complete operating instructions for using the equipment with the plug-in modules. Section VI is the instrument calibration procedure. Section VII is a maintenance procedure. Section VIII is a troubleshooting procedure. Section IX lists the electrical components by subassemblies. Schematic and wiring diagrams are included in the Appendix.

Section X contains information applicable to the dash 1 configurations. Dash 1 configurations are units which have AM capability. The AM capability involves adding circuitry to the plug-in modules. All other portions are identical to the standard modules.

Section XI contains information applicable to the dash 2 configurations. Dash 2 configurations are units which have FM capability. The FM capability involves adding circuitry to the plug-in modules. All other portions are identical to the standard modules.

Section XII contains information on the switchable racks, special racks, carrying cases, etc.

SECTION II

EQUIPMENT DESCRIPTION

2-1. PURPOSE

The AILTECH 445 Power Oscillator (Figure 2-1), when used in conjunction with the plug-in modules listed herein, is a continuously variable (in frequency and power output) source of RF signals from 2 to 2500 MHz. The relatively high power output of this system makes it a versatile and valuable aid in EMC susceptibility testing, antenna evaluation, calibration of power measuring devices, amplifier drivers, and other applications requiring more power than available from milliwatt signal generators. The extremely constant power output versus frequency characteristics of this power oscillator increases its versatility as a research tool in the development of RF equipment. Output power is continuously variable from 50 mW to as high as 50 W with most plug-in modules (see Table 2-1).

2-2. GENERAL DESCRIPTION

The AILTECH 445 power oscillator is housed in a rugged, attractive carrying case with all controls and external connectors mounted on the front panel. All plug-in power oscillator modules are identical except for the FREQUENCY (MHz) scale that shows the output frequency. A power meter has been provided with two scales, for 10-W and 50-W measurements. Removable side covers allow easy access to electronic components. Units having serial numbers of 452 and higher are designated as AILTECH 445A; these are capable of operating on 115 V or 230 V.

2-3. SPECIFICATIONS

Table 2-1 lists the specifications for the AILTECH 445 Power Oscillator.



FIGURE 2-1. AILTECH 445 POWER OSCILLATOR

**TABLE 2-1. AILTECH 445 POWER OSCILLATOR
SPECIFICATIONS**

Plug-in Module	Frequency	Max. Rated Power Output*
Model 3201**	10 kHz to 2 MHz	40 W at 10 kHz; 10 W at 2 MHz
Model 183	2 to 10 MHz	40 W
Model 184	10 to 50 MHz	50 W
Model 185	50 to 200 MHz	50 W
Model 186	200 to 500 MHz	50 W
Model 187	500 to 1000 MHz	50 W
Model 188A	1000 to 2000 MHz	25 W
Model 189A	2000 to 2500 MHz	15 W
Model 189A	2000 to 2500 MHz	15 W

Size:	8 in. wide, 11-1/2 in. high, 17 in. deep
Weight:	Less than 50 pounds
Input Power:	115/230 Vac, $\pm 10\%$, 50/60 Hz, 375 W nominal
Frequency	
Calibration:	Direct reading, $\pm 1\%$ (except Model 183, $\pm 5\%$) of actual frequency at best coupling after 30 minutes operation at highest rated power
Stability:	$\pm 0.002\%$ for 10 minutes after 2 hours stabilization at a constant power and frequency
Tuning:	Single control
Power	
Stability:	± 0.2 dB per hour after 2 hours stabilization at a constant power and frequency
Metering:	Front panel reads forward power on 10-W or 50-W scale, and reflected power on 10-W scale
Modulation	
Internal Frequency:	1 kHz, ± 10 Hz, adjustable
Internal Waveform:	100% square wave
External:	Pulse modulation to full CW power, no residual RF between pulses; pulse shape a function of frequency and power level
Amplitude Modulation (as an option on "-1" plug-in modules):	See Section X
Frequency Modulation (as an option on "-2" plug-in modules):	See Section XI
Residual FM:	Less than 0.005% in continuous-wave operation
Residual AM:	Less than 2% continuous-wave operation

*Power: Continuously adjustable from 50 mW to maximum rated output.

**Amplifies output of low power signal source up to specified power. Full output is provided with 500-mW drive. Forward power metering is displayed.

SECTION III

GENERAL THEORY OF OPERATION

3-1. OPERATING MODES

Three operating modes are possible, allowing the power oscillator to be used as a continuous-wave oscillator, 1-kHz square-wave oscillator, or as an externally pulsed oscillator.

3-2. CONTINUOUS WAVE OPERATION

Turning the MODULATION switch to OFF removes -150 volts dc from the 1-kHz multivibrator while decoupling the multivibrator output from the modulator preventing accidental modulation of the oscillator. In OFF position, the pulse shaping circuit and modulator output are disconnected.

3-3. INTERNAL OPERATION

Turning the MODULATION switch to 1 kHz connects -150 Vdc to the 1-kHz multivibrator while coupling the multivibrator output to the modulator. The pulse shaping circuit is switched into the circuit and the grid of the oscillator is connected to the modulator output through resistor R508.

3-4. EXTERNAL OPERATION

Turning the MODULATION switch to EXT removes -150 Vdc from the 1-kHz multivibrator, preventing accidental internal modulation. The input of the modulator is switched to the front panel EXT PULSE jack while connecting the modulator output to the oscillator grid and connecting the pulse-shaping circuit into the circuit.

SECTION IV

CIRCUIT DESCRIPTION

All circuitry used in the AILTECH 445 Power Oscillator is contained within the basic unit, while circuitry only directly involved with the power oscillator cavity is in the plug-in modules (this simplifies maintenance and troubleshooting). The following circuit description is presented in block form (see Figure 4-1) and describes major subsystems. The locations of electrical components (identified by reference designators) are shown on Figure A-1 in the Appendix or on other drawings referenced. (See page A-1 of the Appendix for complete list of drawings).

4-1. POWER SUPPLY

The power supply provides all filament and regulated dc voltages needed to operate and control the power oscillator. Switching the front panel toggle switch to the ON position applies voltage to transformer T101 primaries. Transformer T101 has two primary windings. These windings are both 115 V and are wired in series for 230-V operation. T101 thus acts as an autotransformer to supply 115 V to T201 and the fan B401. Fuse F401 is changed to a 2A, Slo-Blo for 230-V operation.

The unit will operate on 230 V, 50 Hz $\pm 10\%$; however, for exceptionally low line voltages T101 has 100-V taps. For use below 200 V, change the wires from terminal 10 to terminal 11 and the wires from terminal 13 to terminal 14.

Applying power to the primary of transformer T101 energizes the plus dc power supply system, bias supply for the regulators, and applies filament voltage to all tubes while lighting the filament panel lamp DS301. About 1 minute later the time delay relay K103 closes, applying voltage to the transformer T102 primary through power adjust variac T201 and lighting indicator lamp DS302. Transformer T102 supplies the regulated high voltage to the power oscillator, putting it into operation.

4-2. TIME DELAY

The AILTECH 445 Power Oscillator high-voltage turn-on time delay (Figure A-4 in the Appendix) is furnished by a solid state relay. Capacitor C601 is charged through resistor R603 from a fixed voltage source supplied by diode CR602. This voltage level is served by transistor Q601 (a high input impedance field-effect transistor). When there is enough current

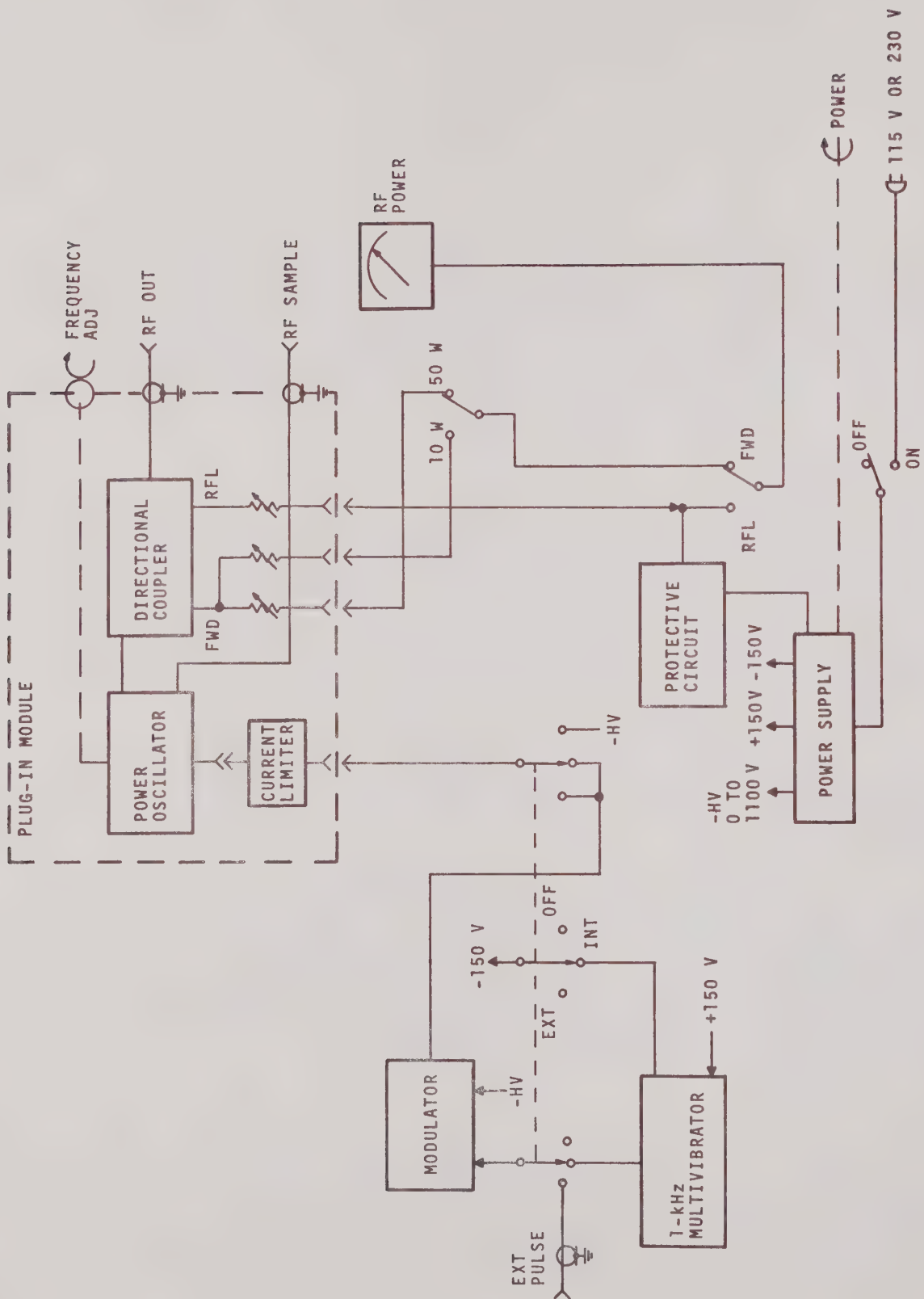


FIGURE 4-1. POWER OSCILLATOR BLOCK DIAGRAM

through resistor R606, the voltage at the drain of transistor Q601 is negative enough to turn on the Schmitt trigger composed of transistors Q602 and Q603. The collector load of transistor Q602 is the coil of relay K102, so when capacitor C601 is charged long enough (about 1 minute), the Schmitt trigger fires and closes relay K102; this applies high voltage to the AILTECH 445 Power Oscillator. Diode CR601 and resistor R601 form a rapid discharge path for C601 when power is turned off.

4-3. PLUS 300-V AND 150-V SUPPLY

The +300 Vdc and +150 Vdc required for operation of the multivibrator, protective circuit, and regulator circuits are supplied by the bridge rectifier circuit, CR102. The unregulated 300-V output of bridge rectifier circuit CR102 is filtered by capacitor C105 and supplies B+ voltage to tube V107. The unregulated 300 V is dropped to +150 V through resistor R119 and is regulated by tube V104. The regulated +150 V is used to supply B+ voltage to tubes V108 and V101B.

4-4. MINUS 150 AND 85 V SUPPLY

The -150 Vdc and -85 Vdc required for operation of the multivibrator and regulator circuits are supplied by the bridge rectified circuit CR103. The unregulated -300 V output of bridge rectifier circuit CR103 is filtered by capacitor C107 and dropped to -150 V by resistor R120 where it is regulated by tube V105. The regulated -85 V is derived by dropping the -150 V through resistor R125 and is regulated by tube V106. The regulated -150 and -85 V is used to supply bias and reference voltages on tubes V101, V102, V107, and V108.

4-5. POWER OSCILLATOR FILAMENT SUPPLY

The filament supply for the power oscillator is regulated by ballast lamp RT101, and the voltage level is determined by resistor R152 and R114 in the plug-in module. The value of resistor R114 is selected to provide best filament emission of the power oscillator tube. RT102 is to limit surge current at turn on. RT102 has been installed in units S/N 552 and above.

4-6. HIGH-VOLTAGE SUPPLY

The high-voltage supply is actuated by the closure of time delay relay K103, which supplies voltage to transformer primary T102 through the power control variac T201. Bridge rectifier CR101 rectifies the unregulated high voltage, which is then filtered by inductor L101 and capacitor C104, and supplies the regulator circuit. The regulator consists of series tube V103 controlled by a differential amplifier (tubes V107 and V108). Tube V102 is

a constant current tube providing a constant drop across resistor R128. Resistor R129 and capacitor C107 on tube V107 provide a feedback loop to prevent "motorboating" or high-frequency oscillations.

Variable resistor R137 controls the regulation point of the high-voltage supply. Resistor R134 is provided to allow balancing of the differential amplifier. Resistor R121 allows setting of the control voltage on the series tube V103 by adjusting the voltage drop across resistor R128.

Resistor R203, which is ganged to the power control variac T201, controls the regulator circuit over the complete operating range by varying the reference voltage to the differential amplifier.

4-7. MODULATOR SYSTEM

The internal 1-kHz modulator provides 100 percent pulse modulation of the power oscillator. Modulation is accomplished by cutting the grid on and off in the power oscillator.

WARNING

Injury or death to personnel may result from 1150 V present at the exposed terminals of the modulator.

The 1-kHz signal to the modulator is generated by the free-running multivibrator tube V101. The multivibrator consists of the triode section of tube V101A, and the screen section of the pentode of tube V101B. The remaining part of the pentode section of tube V101 provides a constant current output and isolation between the multivibrator and modulator. Potentiometer R105 provides frequency adjustment of the free-running multivibrator. Potentiometer R156 provides adjustment of square wave symmetry.

The 50 to 100 V pulse output of tube V101 is coupled to the modulator circuit through switch S501A. The transistor modulator (transistors Q501 and Q502) provides the required drive signal to drive the power oscillator on and off.

Diode CR501 provides the operating voltage for the transistor circuitry. Resistor R509 and capacitor C506 provide a pulse-shaping network that allows adjustment of the operating bias to result in the best possible pulse shape. This network is removed from the circuit in continuous wave operation to prevent power loss.

4-8. POWER OSCILLATOR

The power oscillator (Figure A-2 in the Appendix) is a modified Colpitts grid oscillator. The grid is grounded to RF by Capacitance.

The grid to plate capacity is resonated by a short-circuited transmission line. Power is obtained from the plate line by a capacitive probe. The small capacity resonated with the plate line, which is tuned slightly to the inductive side, transforms the output impedance of the power oscillator to 50 ohms.

4-9. GRID AND PLATE CURRENT LIMITER

The grid current limiter circuit protects the oscillator tube by keeping the grid current within limits under all operating conditions. This grid current limiter consists of transistor Q701, diode CR701, and resistors R702 and R703. As the grid current (collector current of transistor Q701) goes above a certain preset value, the emitter-collector voltage of transistor Q701 is increased; this increases the negative bias on the tube, which brings the current back down.

The value of the current at which the transistor starts to limit is factory preset by tuning resistor R702. Readjustment should not be necessary.

The cathode resistor R510 in the oscillator circuit protects the oscillator tube by keeping the plate current within limits under all operating conditions.

4-10. PROTECTIVE CIRCUIT MODULE

If the power oscillator is operated without a 50-ohm load, the protective circuitry (Figure A-5 in the Appendix) used will prevent excessive absorption of power within the oscillator cavity, thereby protecting the power oscillator tube. A terminal load other than 50 ohms results in the generation of a negative dc signal from the directional coupler DC701 (Figure A-2 in the Appendix). This signal is coupled into the base of differential amplifier transistor Q801 causing its output to go negative, this causes the emitter follower Q802 output to go negative. The Schmitt trigger (composed of transistors Q803 and Q804) is triggered with a negative voltage; this activates relay K801. (Contacts B2 and B3 of K801 are opened, thus breaking the coil current of K102 and removing the high voltage. It also latches Q804 into the ON position, holding K801 in the ON position until the READY/RESET lamp is depressed.) This turns the AILTECH 445 OFF. If the output load mismatch has not been corrected, the AILTECH 445 will be turned OFF again until the correct load has been furnished. The allowable amount of mismatch is determined by adjustment of resistor R706 in the plug-in module used. Resistor R806 in the

protective circuit (Figure A-5 in the Appendix) sets a standard value of input voltage required to trip the protective circuitry, thus allowing each plug-in module to be set for its individual directional coupler.

NOTE

To restore the high voltage after the unit has faulted, depress the READY/RESET lamp and hold for a second. The READY/RESET lamp will come on once the initial time delay has been attained and the fault cleared.

SECTION V

OPERATION

5-1. OPERATING CONTROLS

All operating controls for the AILTECH 445 Power Oscillator are located on the front panel (see Figure 2-1).

5-2. PRELIMINARY ADJUSTMENTS

- a. Switch ON-OFF switch to OFF position.
- b. Set switch S401 on rear panel to correct position. (that is, 115 V or 230V)

NOTE

For 230-V operation F401 is 2 A, for 115-V operation it is 4 A

- c. Connect power cable to a source of 105 to 125 V, or 210 to 250 V, 50 to 60 Hz.
- d. Install desired plug-in module.

CAUTION

The ON-OFF switch should be in OFF position whenever installing or removing a plug-in module.

- e. Connect the RF OUT jack to equipment being tested.
- f. Turn MODULATION switch to desired mode of operation.
- g. Set RF POWER switch to desired full scale range.
- h. Set RFL-FWD switch to FWD.
- i. Rotate RF POWER OUTPUT ADJ control to RF OFF position.

5-3. OPERATING PROCEDURE

- a. Switch ON-OFF switch to ON and note that amber lamp is lit. After 60 seconds time delay, the red READY/RESET lamp will light.

- b. Adjust FREQUENCY ADJ control to desired frequency.

NOTE

Calibration accuracy prevails for clockwise rotation.

- c. Turn RF POWER OUTPUT ADJ control in a clockwise direction until there is an indication of power on the RF POWER meter. If COUPLING control is badly misadjusted, it may be necessary to adjust it in order to obtain an indication.
- d. Adjust COUPLING control for maximum power output.

NOTE

Normally, when adjusting the COUPLING control it will tune through a peak in power output (this is optimum coupling). On some plug-in modules it is not possible to tune through peak at the frequency extremes; however, it will always be possible to obtain rated power and the operation is not affected.

Initial frequency and coupling adjustments should be made at reduced power. On the Model 183 plug-in module do not switch band change with RF POWER on. On the Model 184 plug-in module, if the unit is badly overcoupled there may be a tendency for "quenching" which can cause the fault circuit to be actuated.

- e. Set the RF POWER OUTPUT ADJ control to the desired power and repeak COUPLING control.

NOTE

Prolonged operation above rated power can cause cavity damage and will reduce tube life! The power source is designed to operate into a nominal 50-ohm load and is protected against damage as a result of operation into an open, short, or badly mismatched load. If the reflected power exceeds 10 W, the high voltage will automatically shut off and the READY/RESET lamp will extinguish.

f. The reflected power can be measured by switching the RFL-FWD switch to RFL position. In the RFL position the full-scale meter reading is 10 W regardless of the RF POWER meter switch position.

g. When operating with the modulation switch in the INT or EXT position, it is necessary to view the detected waveform on a scope and adjust the pulse shape knob for the best pulse shape and the output coupling as necessary to prevent quenching. (Quenching is evidenced by an approximately 2-MHz amplitude modulation of the RF.) A detector can be conveniently connected to the RF SAMPLE jack for this purpose. For EXT operation, a positive pulse of at least 10 V is required to modulate the power sources.

NOTE

On units below S/N 377, 50 to 100V is required.

SECTION VI

INSTRUMENT CALIBRATION PROCEDURE

The following procedure has been prepared for use by military Metrology Laboratories and is included here only as a guide.

6-1. INTRODUCTION AND DESCRIPTION

This procedure describes the calibration of the ALTECH 445 Power Oscillator and its associated plug-in modules, Models 183, 184, 185, 186, 187, 188A, and 189A. The instrument being calibrated will be referred to herein as the TI or Test Instrument.

TABLE 6-1. CALIBRATION DESCRIPTION

Test Instrument Characteristics	Performance Specifications	Test Method
Frequency range	AILTECH 445 with plug-in modules: 183 2 to 10 MHz 184 10 to 50 MHz 185 50 to 200 MHz 186 200 to 500 MHz 187 500 to 1000 MHz 188A 1000 to 2000 MHz 189A 2000 to 2500 MHz Direct reading frequency dial Limit of error: $\pm 1\%$ of actual frequency at optimum coupling after 1/2 hour operation at maximum rated power	Tested by comparison with an accurate frequency measurement system
Frequency stability	All models $\pm 0.002\%$ for 10 minutes after 2 hours stabilization at a constant power and frequency	Not tested

TABLE 6-1. (Cont'd)

Test Instrument Characteristics	Performance Specifications	Test Method
Output power	AILTECH 445 with plug-in modules: 183 40 W 2-10 MHz 40 W 7-10 MHz 184 50 W 185 50 W 186 50 W 187 50 W 188A 25 W (1000-2000) 189A 15 W (1800 189A 15 W	Output power is measured using standard power meter and high-power attenuator
Power stability	All models ± 0.2 dB per hour after 2 hours stabilization at a constant power and frequency	Not tested
Power metering	Front panel meter reads 10 or 50 W full-scale forward power or 10 W full-scale reflected power	Not tested
Internal modulation	100% square wave at 1 kHz ± 10 Hz, adjustable	Modulated RF is detected with a crystal detector and displayed on an oscilloscope or monitored by an electronic counter
External modulation	Pulse modulation to full CW power, with no residual RF between pulses	The TI is externally pulse modulated, the output detected with a crystal detector and the detector output monitored on an oscilloscope
Residual FM	Less than 0.005%	Not tested
Residual AM	Less than 2% in CW mode	Not tested

6-2. EQUIPMENT REQUIREMENTS

Minimum use specifications (Table 6-2) are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

TABLE 6-2. TEST EQUIPMENT MINIMUM USE SPECIFICATIONS

Calibration Equipment	Minimum Use Specifications
Termination Weinschel 535 MN	Frequency range: 2 to 3000 MHz Power rating: 1.0 W minimum
High-Power Attenuator Narda 765-20	Attenuation: 20 dB nominal* Power rating: 50 W minimum Frequency rating: 2 to 3000 MHz
BNC "Tee" Connector (Stock item)	UG-274 B/U
Electronic Counter Hewlett-Packard 5245L with 5253B and 5254B plug-in converters	Frequency range: 2 to 3000 MHz Limit of error: $\pm 0.1\%$
Oscilloscope Hewlett-Packard 130C or B	Frequency response: dc to 500 kHz
Calorimetric Power Meter Hewlett-Packard 434A	Frequency range: 2 to 3000 MHz Power range: 1 to 10 W Limit of error: $\pm 2\%$ of full scale
Autotransformer General Radio W5MT3A, or Superior Electric UC IM	Input voltage: 105 to 125 V, 60 Hz, 1 $\emptyset$ Output voltage: adjustable from 105 to 125 V, metered Current rating: 5 A minimum

*The attenuation factor of the attenuator must be known throughout the band (2 to 3000 MHz)

TABLE 6-2. (Cont'd)

Calibration Equipment	Minimum Use Specifications
20-dB Attenuator Weinschel 50-20	Limit of error: ± 0.2 dB VSWR: 1.15 maximum
Crystal Detector Hewlett-Packard 423A	Sensitivity: 0.4 mV/uW CW
Pulse Generator Hewlett-Packard 212A	Voltage output: 0 to +50 V Repetition rate: 40 to 4000 pps, adjustable Pulse length: 0.5 to 10.0 μ s, adjustable

6-3. PRELIMINARY OPERATIONS

a. Ensure that all power switches are off, then connect the applicable equipment as shown in Figure 6-1.

CAUTION

Operation without a load or a badly mismatched load on the RF output will result in activation of the fault circuit.

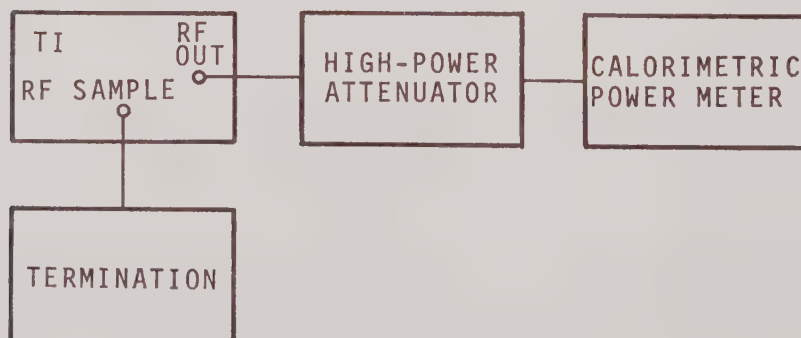


FIGURE 6-1. OUTPUT POWER TEST CONFIGURATION

- b. Adjust the autotransformer voltage control fully CCW, and connect the TI power cord to the autotransformer.
- c. Connect all auxiliary equipment to the appropriate power source.
- d. Set the TI controls as follows:

RF POWER OUTPUT ADJ control	fully CCW
PULSE SHAPE switch	CW
FREQUENCY ADJ control	middle of frequency band
COUPLING control	fully CCW
ON-OFF switch	ON
- e. Adjust the autotransformer for a 115-V meter indication.
- f. Set the controls on the auxiliary equipment to prevent damage when power is applied.
- g. Turn on all auxiliary equipment power switches, and allow a 15-minute warmup period.

NOTE

Unless otherwise specified, verify the results of each test and take corrective action before proceeding.

6-4. OUTPUT POWER MEASUREMENT

- a. Set the calorimetric power meter range switch to 1 dBW.

CAUTION

To prevent operation of the TI at more than its rated power output and to prevent damage to the attenuator, the attenuation factor of the high-power attenuator must be taken into account to determine the exact power level in the following steps.

b. Adjust the TI RF POWER OUTPUT ADJ control to obtain an RF POWER meter indication as determined by the following formula. Adjust the COUPLING control to obtain maximum power from the TI. Decrease RF POWER OUTPUT ADJ control as necessary to limit power to maximum rating.

$$P_T = P_I + C$$

where P_I = Indicated power in dBW

P_T = Output power from TI in dBW

C = Attenuation factor of high-power attenuator in dB

EXAMPLE: When testing the TI with Model 186 plug-in module (200 to 500 MHz), to obtain +17 dBW output from the TI at 280 MHz with an attenuation factor of -20.6 dB at 280 MHz, a power meter indication of -3.6 dBW (+17 dBW -20.6 dB) would be required.

c. Slowly adjust the TI FREQUENCY ADJ control over its range and verify that a power level of +17 dBW (AILTECH 445 with Model 184, 185, 186, or 187 plug-in module) or +14 dBW (AILTECH 445 with Model 188A) plug-in module) or +11.7 dBW (AILTECH 445 with Model 189A plug-in module) can be obtained at any frequency in the respective frequency bands. Adjust the COUPLING control as required for maximum output power.

6-5. FREQUENCY DIAL CALIBRATION

a. Connect the applicable equipment as shown in Figure 6-2.

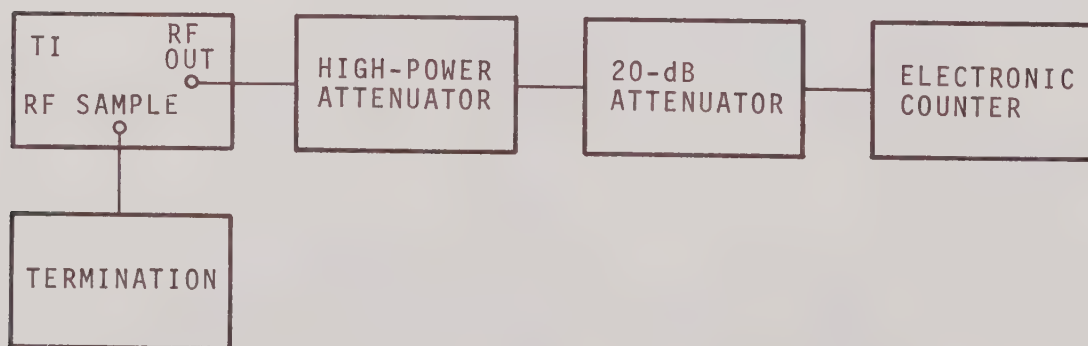


FIGURE 6-2. FREQUENCY TEST CONFIGURATION

b. Depending on the plug-in module being tested, adjust the TI to the RF POWER meter and FREQUENCY dial indication listed below. The COUPLING control should be set for maximum output power at all times.

<u>AILTECH 445 with Plug-in Module</u>	<u>Frequency (MHz)</u>	<u>RF Power (dBW)</u>
183	10	17
184	50	17
185	200	17
186	500	17
187	1000	17
188A	2000	14
189A	2500	11.7

c. Adjust the electronic counter for a frequency indication. The counter should read the TI output frequency to within $\pm 1.0\%$ of the TI FREQUENCY dial indication.

d. Repeat steps b and c at the frequency dial indications and power levels listed below.

<u>AILTECH 445 with Plug-in Module</u>	<u>Frequency (MHz)</u>	<u>RF Power (dBW)</u>
183	2, 4, 6, and 8	17
184	40, 30, 20, and 10	17
185	150, 100, 75, and 50	17
186	400, 300, and 200,	17
187	800, 700, 600, and 500	17
188A	1800, 1600, 1400, 1200, and 1000	14
189A	2400, 2300, 2200, and 2100	11.7

e. After testing the lowest frequency listed for the plug-in module being tested in step d, adjust the autotransformer for a 105-V meter indication. Wait one minute. The electronic counter should indicate within $\pm 1.0\%$ of the TI FREQUENCY DIAL indication.

f. Return autotransformer to a 115-V meter indication.

6-6. INTERNAL MODULATION

- a. Connect the applicable equipment as shown in Figure 6-3.

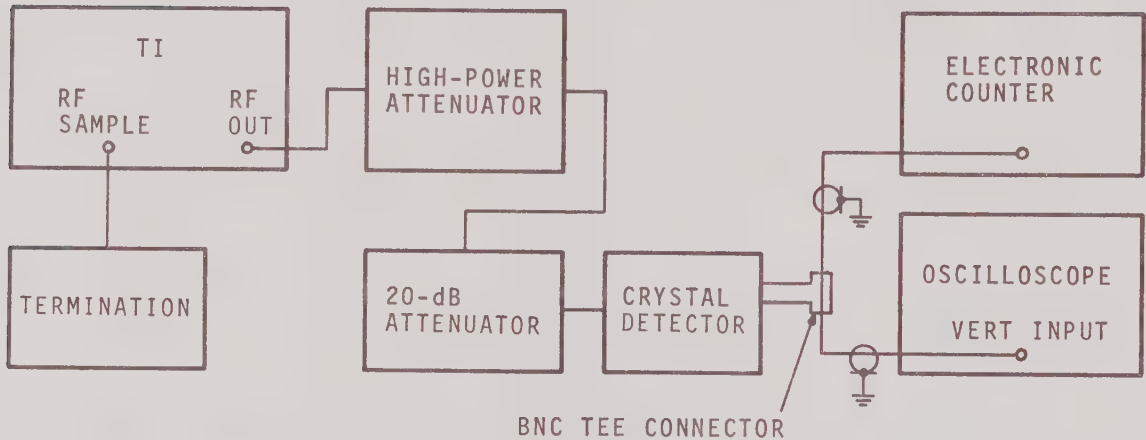


FIGURE 6-3. INTERNAL MODULATION TEST CONFIGURATION

- b. Set the TI MODULATION switch to INT.
- c. Adjust the oscilloscope controls as required to obtain complete cycle of a 1-kHz square wave. Adjust the TI PULSE SHAPE control for the best obtainable presentation. Verify a clean, undistorted, 100 percent modulated square wave as the TI FREQUENCY ADJ control is adjusted through the entire frequency range. The electronic counter shall indicate 0.99 to 1.01 kHz.

6-7. EXTERNAL PULSE MODULATION

- a. Connect the applicable equipment as shown in Figure 6-4.
- b. Adjust the pulse generator controls for an output pulse 50 V in amplitude, 50 microseconds in length, and having a PRF of 1.0 kHz.
- c. Set the TI MODULATION switch to EXT.
- d. Adjust the oscilloscope controls for a suitable display.

e. Rotate the TI FREQUENCY ADJ control through the entire frequency range, and verify that a pulse is present on the oscilloscope at all frequencies. Adjust the TI COUPLING control as necessary.

f. Unless other measurements are to be performed, place all power switches to off or standby and disconnect the TI from test equipment.

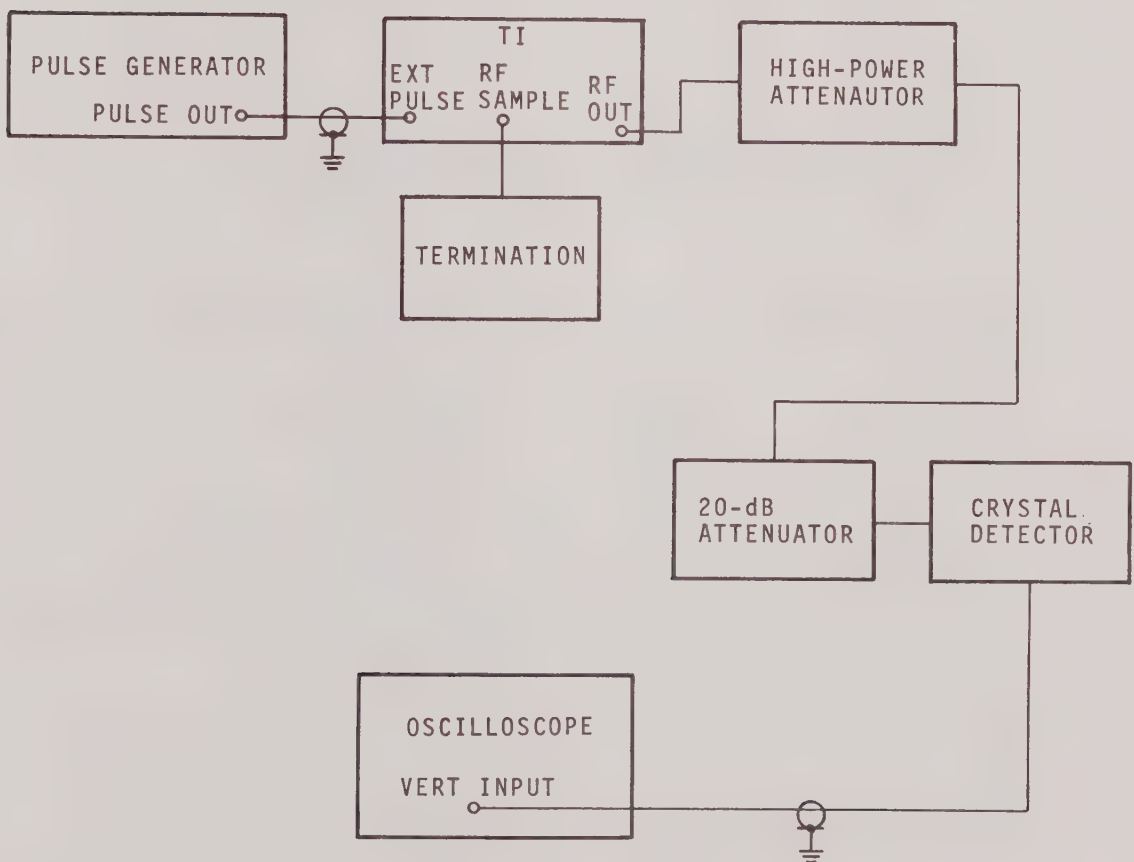


FIGURE 6-4. EXTERNAL MODULATION TEST CONFIGURATION

SECTION VII

MAINTENANCE

7-1. VACUUM TUBE REPLACEMENT

Any defective or weak tubes should be replaced immediately because continued operation may degrade other components and system performance. All tubes, except the power oscillator tube, are contained within the basic unit and are accessible once the side covers have been removed.

CAUTION

When removing or replacing tubes, be sure that reinstalled tubes are in their correct sockets and are seated properly.

Further adjustment to the power supply may be needed after replacing regulator tubes (see Paragraph 7-9).

7-2. POWER OSCILLATOR TUBE REPLACEMENT

The power oscillator tube is located within the power oscillator cavity contained on each of the plug-in modules. Because of the differences in frequency coverage of each plug-in module, cavity construction varies, making unique disassembly procedures necessary for the tube replacement. Using the following disassembly steps for removing the power oscillator tube from the plug-in modules specified. After replacing tube, unit should be operated 30 minutes with power set control at zero.

7-3. MODELS 183, 184, 185, AND 186 PLUG-IN MODULES (FIGURES 7-1 AND 7-2)

- a. Disconnect the power plug (P601) from the rear of the cavity.
- b. Remove the No. 6-32 x 3-1/4 screws and lockwashers on the rear of the cavity.
- c. Unplug cathode pin that protrudes from rear section and connects to C702 and C703 and remove grid current limiter module (for Model 183 only).

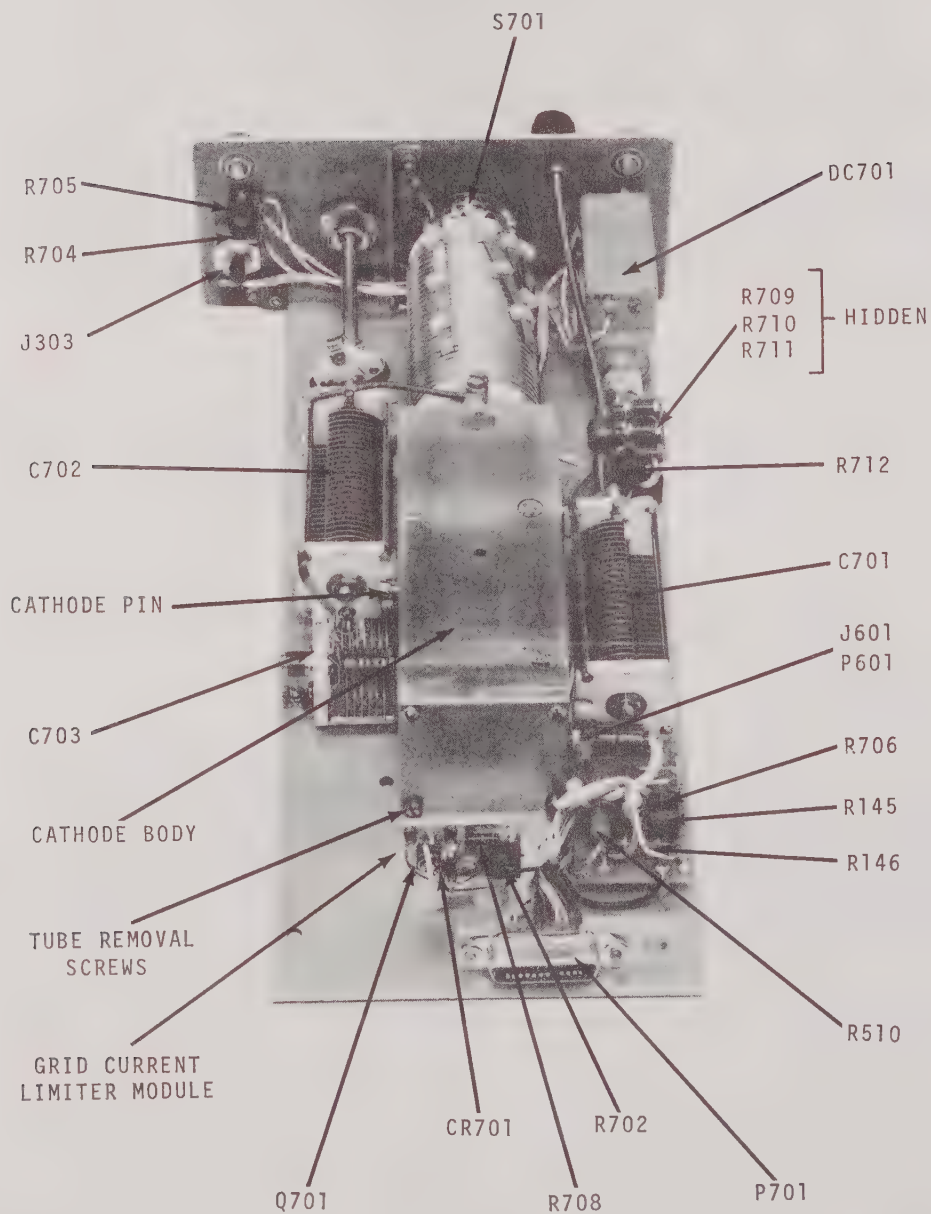
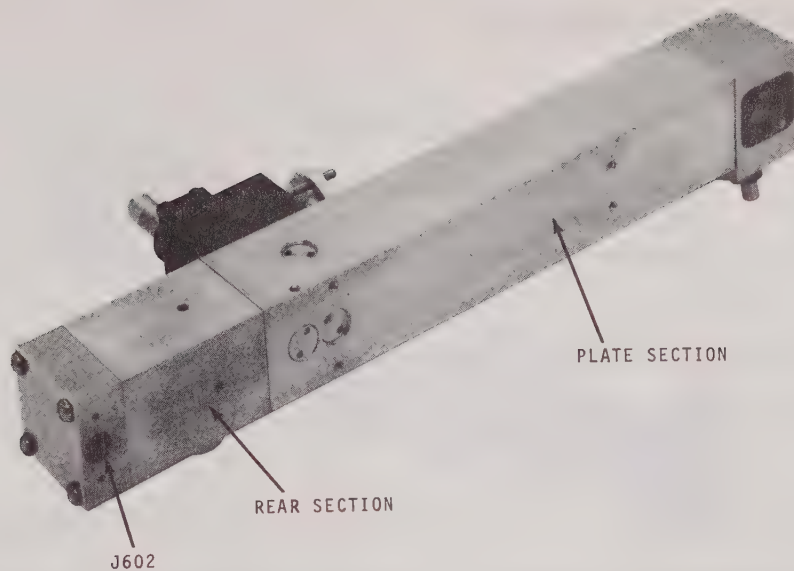
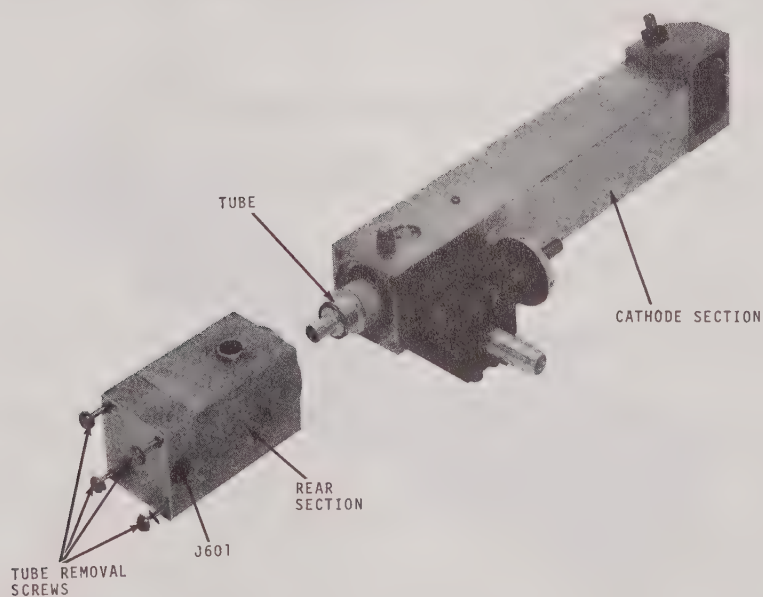


FIGURE 7-1. MODEL 183 PLUG-IN MODULE



A. ASSEMBLED.



B. DISASSEMBLED.

FIGURE 7-2. CAVITY FOR MODELS 184-4, 185-4, AND 186-4
PLUG-IN MODULES

- d. Separate the cathode body from the plate section of the cavity.

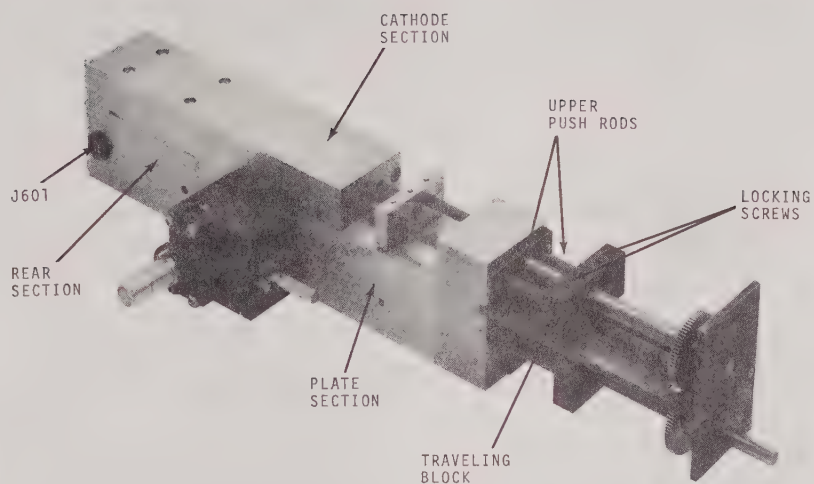
CAUTION

The cathode body must be pulled straight out (rearward), using extreme care not to damage the inside of the cavity.

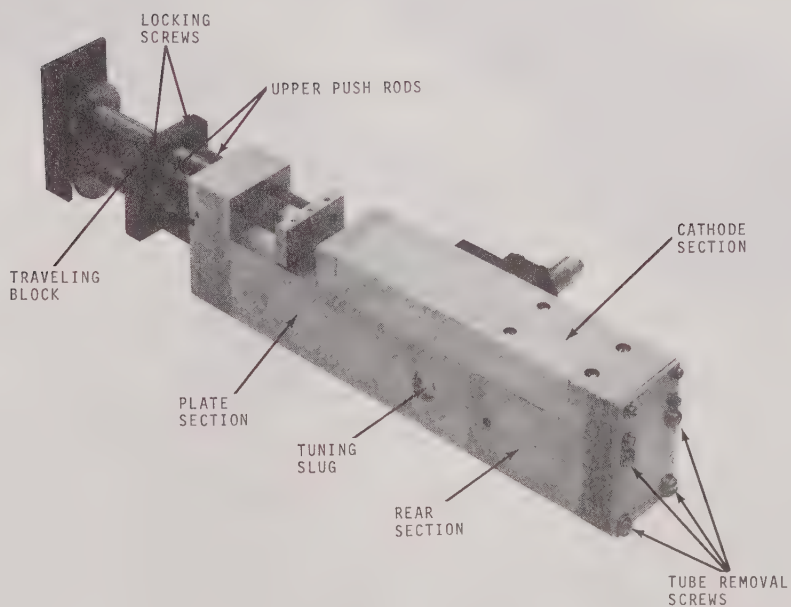
- e. Remove the tube by turning it counterclockwise.
- f. Remove the locking washer from the tube and replace it on a new tube.
- g. Install new tube, rotating it clockwise into cavity, finger tight.
- h. Reassemble the cathode section to the plate section of the cavity.
- i. Replace and tighten the No. 6 screws and lockwashers securing the cathode section to the plate section of the cavity.
- j. Reconnect plug P601 to the side of the cavity.
- k. Replace grid current limiter module (for Model 183 plug-in module only).

7-4. MODEL 187 PLUG-IN MODULE (FIGURE 7-3)

- a. Disconnect power plug P601 from the rear of the cavity.
- b. Remove one No. 6-32 $\times$ 3/16 flat-head screw securing the cavity to the chassis located at the rear of the cavity.
- c. Rotate the FREQUENCY knob to set the FREQUENCY (MHz) scale to 500 MHz.
- d. Carefully mark the two green epoxy upper push rods with reference to the traveling block (see Figure 7-4), so that they may be reinstalled in



A. FRONT VIEW.



B. REAR VIEW.

FIGURE 7-3. CAVITY FOR MODEL 187 PLUG-IN MODULE

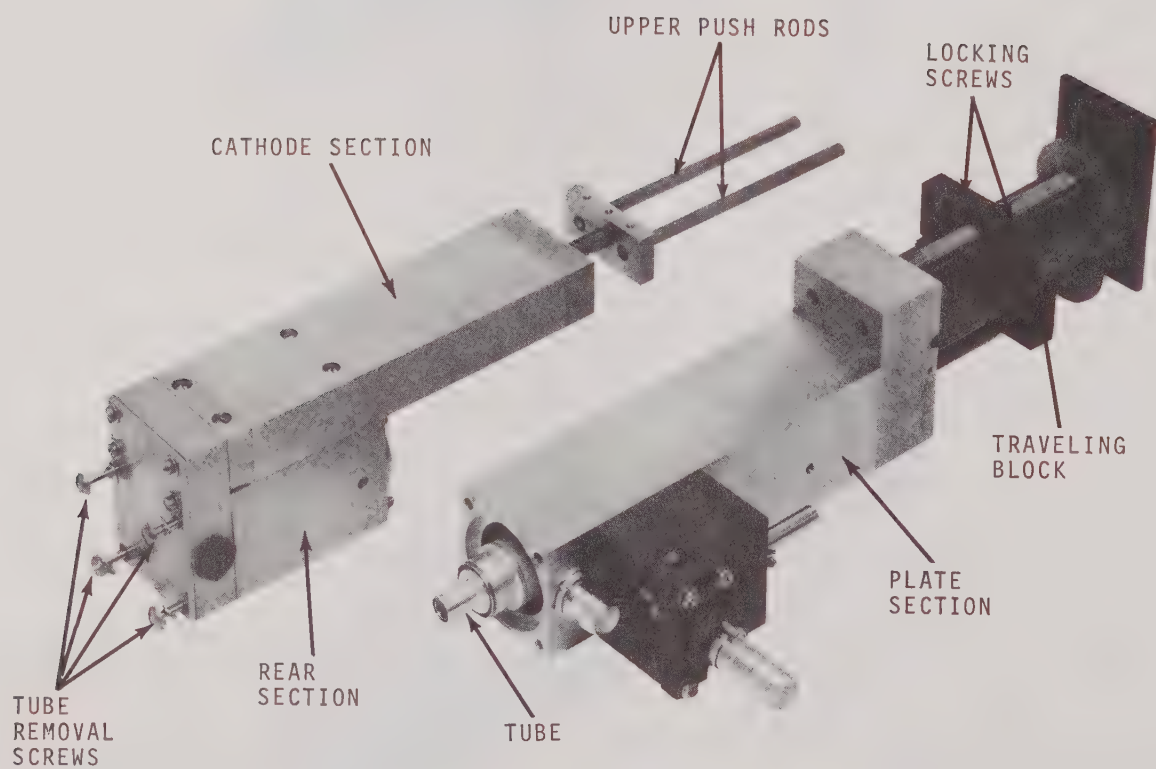


FIGURE 7-4. DISASSEMBLED CAVITY FOR MODEL 187 PLUG-IN MODULE

exactly the same position. Loosen the two No. 4-40 $\times$ 3/16 set screws that secure the two upper push rods in the traveling block.

CAUTION

Do not rotate the block holding the upper push rods with reference to the cathode section; this may damage the interior finger mechanism.

e. Remove the No. 6-32 $\times$ 3-1/4 screws and lockwashers on the rear of the cavity.

f. Insert the tube removal tool (located on the chassis adjacent to the cavity) into the upper right-hand screw hole at the rear of the cavity and turn it clockwise until the cavity breaks apart.

g. Remove the tube removal tool and separate the cathode section from the plate section of the cavity.

CAUTION

The cathode section must be pulled straight out, using extreme care not to damage the inside of the cavity.

h. Remove the tube by turning it counterclockwise.

i. Examine the spring located in the hole from which the tube was removed and make sure it is not damaged.

j. Install new tube, rotating it clockwise into cavity, finger tight.

NOTE

Make sure the spring is in position before putting the new tube in.

- k. Reassemble the cathode section to the plate section of the cavity.

CAUTION

Make sure the upper push rods are aligned properly before completely reassembling the cathode section of the cavity. Use extreme care to prevent damage to the interior finger mechanism which is attached to the upper push rods.

- l. Replace and tighten the four No. 6 screws and lockwashers securing the cathode section to the plate section of the cavity.

- m. Reset the upper push rods to their original position and tighten the two No. 4 set screws in the traveling block.

- n. Replace and tighten the No. 6 flat-head screw securing the cavity to the chassis.

- o. Reconnect power plug J601.

CAUTION

Use extreme care not to turn the tuning slug too far in, otherwise damage to capacitors may result.

- 4. Replace the right-hand side cover of the basic unit.

7-5. MODELS 188A AND 189A PLUG-IN MODULES (FIGURE 7-5)

- a. Disconnect power plug P601 from the rear of the cavity.
- b. Remove three No. 6-32 $\times$ 3/16 flat-head screws securing the cavity to the chassis. (One is located at the rear of the cavity and the remaining two at the center of the cavity.)
- c. Loosen the No. 6-32 set screw in the coupling located on the main travel rod.

CAUTION

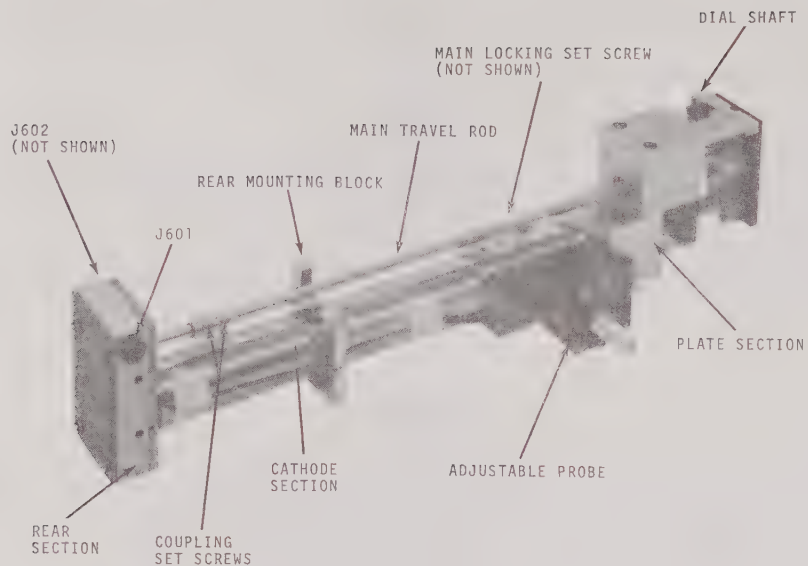
Use extreme care to keep both ends of the main travel rod stationary; if either end rotates during subsequent steps, the plate-to-cathode alignment will be offset.

- d. Loosen the No. 8-32 set screw on the end of the flexible shaft connected to the adjustable probe on the cavity.
- e. Disconnect RF sample connector P303 from the cavity.
- f. At the adjustable probe, disconnect J603 which connects the adjustable probe to the directional coupler.
- g. Loosen the main locking set screw (Figure 7-5) located on the side opposite the adjustable probe.
- h. Pull the rear of the cavity straight back to expose the tube.

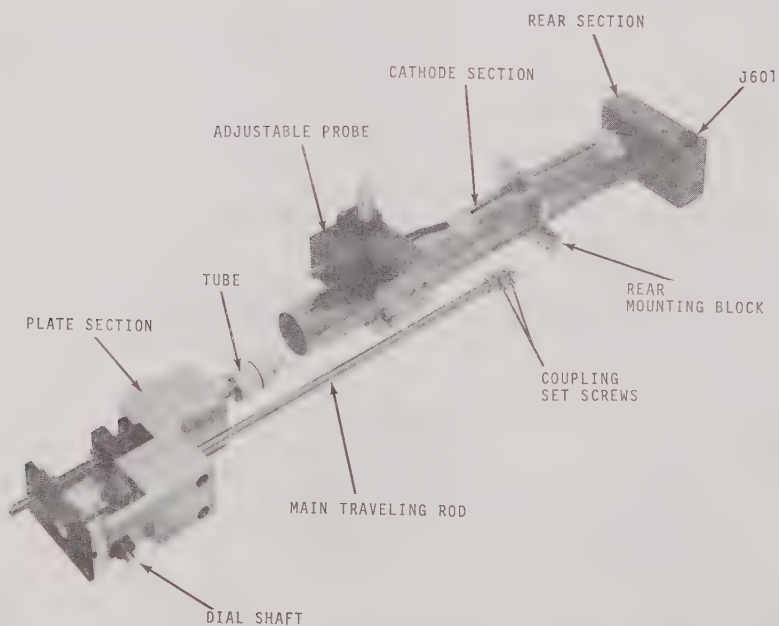
CAUTION

Pull the rear section straight out and use extreme care not to damage the inside of the cavity.

- i. Remove the tube by turning it counterclockwise.
- j. Replace with new tube, rotating it clockwise, finger tight.



A. ASSEMBLED.



B. DISASSEMBLED.

FIGURE 7-5. CAVITY FOR MODELS 188A AND 189A PLUG-IN MODULES

- k. Reconnect the rear section to the cavity.
- l. Reinstall the three No. 6-32 $\times$ 3/16 flat-head screws securing the cavity to the chassis.
- m. Tighten the main locking set screw on the cavity.
- n. Tighten the No. 6-32 set screw on the coupling joining the two halves of the main travel rod.
- o. Reconnect P303 to J303.
- p. Reconnect the flexible shaft to the adjustable probe and tighten the set screw.
- q. Reconnect power plug J601.

7-6. CLEANING AND LUBRICATION

Cleaning and lubrication is recommended at periodic intervals to promote long life of mechanical parts and ensure trouble free operation of the AILTECH 445 Power Oscillator. Exterior surfaces may be cleaned using a soft, clean cloth, moistened with isopropyl alcohol. Interior components in general are kept clean by the circulating filtered air generated by the rear panel filter assembly. Should any dirt accumulation occur, however, it may be dislodged by using a small, medium textured, bristle brush and wiped clean with a soft, clean cloth moistened with isopropyl alcohol.

7-7. FILTER CLEANING

The filter assembly, located on the rear panel of the basic unit, should be cleaned as often as required, depending on length of time and environmental conditions under which the unit has been operated. It is recommended that the filter element be examined and cleaned at least once every 30 days in the following manner.

- a. Remove filter from the rear panel by snapping the plastic retainer cover out as shown in Figure 9-5.
- b. Wash the filter in hot water and allow to dry.
- c. Spray filter with R. P. Super Filter Coater, manufactured by Research Products Corporation, Madison, Wisconsin 53701.

7-9. POWER SUPPLY ADJUSTMENTS

The power supply contains the bulk of the electronic circuitry used within the basic unit as well as calibration adjustments to be made by servicing personnel. The power supply may require alignment after replacement of regulator tubes or circuit components. To ensure that specified performance levels are met, the following alignment procedure is recommended.

- a. Connect the basic unit together with a plug-in module to the 115-V, 60-Hz line, using a variac to allow control of input power.
- b. Remove side access covers and the plexiglass high voltage safety shield, permitting access to electrical components within the basic unit.

WARNING

The RF unit has a grounded plate, thus placing all modulation and grid circuits at 1000 volts above ground. All terminals behind the plexiglass shield, and the modulator are at a high voltage potential. Extreme care should be exercised in servicing the equipment with the high voltage on, since 1000 volts at greater than 150 milliamps is lethal.

- c. Turn the POWER control fully counterclockwise.
- d. Connect AILTECH 445 Power Oscillator as shown in Figure 6-1.
- e. Remove relay K103 to disable high-voltage circuit.
- f. Short pins 2 and 7 of V108 with a clip lead.

g. Turn AILTECH 445 Power Oscillator on and bring line voltage up slowly with variac to 115 Vac while checking for +150 Vdc at pin B of J603, -150 Vdc at pin F of J603 and -85 Vdc at pin C of J603. In addition, the ac heater voltage (measured across R152) must not exceed the values given for the following plug-in modules:

<u>Model</u>	<u>Ac Heater Voltage (Vac)</u>
183	7.9 to 8.2
184	7.9 to 8.2
185	6.5 to 6.9
186	6.5 to 6.8
187	6.0 to 6.3
188A	5.9 to 6.2
189A	5.9 to 6.2

If voltage is not as specified, verify that there is between 7.9 and 8.2 V across R152 with the plug-in module removed and with a 6.66-ohm load connected across pin 7 and 8 of J701. If not, select R152 to provide 7.9 to 8.2 V. Remove 6.66-ohm resistor and install plug-in module and select R114 to provide specified voltages across R152.

NOTE

If variac has been removed, align as follows:

1. Loosen the set screws on the coupling between T201 and R203.
2. Turn T201 and R203 fully counterclockwise (as viewed from the front panel).
3. Connect a 150 Vdc meter between J603 pin A and ground (pin A positive).
4. Turn the M445A on, and wait until the time delay operates (front panel ready/reset light on).
5. Using the front panel power adjust knob, set T201 for a reading of 100 Vdc on the meter, keeping R203 fully counterclockwise. Tighten the set screws on the coupling.

h. Adjust R134 so that a meter connected between pins 1 and 6 of V107 averages a null as the RF POWER OUTPUT ADJ control is turned from stop to stop.

i. Turn AILTECH 445 Power Oscillator off, remove the jumper installed in step f, and install time delay relay K103.

j. Turn AILTECH 445 Power Oscillator on and verify proper operation of time delay relay K103. This relay should close in about one minute, as shown by the READY/RESET lamp coming on.

k. Slowly advance the RF POWER OUTPUT ADJ control while observing both the pass tube voltage (pin 1 to ground of V103) and balance voltage deviations (pins 1 and 6 of V107). Adjust R137 to maintain the pass tube voltage between 100 and 450 V, and adjust R121 so that balance deviations remain between ± 118 V.

l. Observe negative high voltage on high-voltage bridge rectifier CR101 negative terminal (black dot on rectifier) while increasing power setting. Adjust R137 for 1150, ± 5 V when RF POWER OUTPUT ADJ control is rotated fully clockwise.

NOTE

The negative high voltage should never be allowed to exceed 1150 V.

m. Vary input line voltage from 103.5 to 126.5 Vac. Observe that voltages are within previously established limits. Adjust R121 so that balance deviations are minimum for all combinations of input line voltages.

n. Check that ripple voltage of the high voltage is less than 220 mV peak-to-peak... using an oscilloscope and high-voltage probe connected to the black dot terminal of CR101.

o. Check the output frequency of the multivibrator on pin 6 of V101 (this square wave is about 110 V peak-to-peak). Adjust the output frequency to 1000 Hz by varying R105. Adjust symmetry using R156. Best square wave. NOTE: Best square wave symmetry stability is obtained NOTE: Best square wave symmetry stability is obtained using GE 6U8A for V101.

7-10. POWER SUPPLY ALIGNMENT

Power supply alignment is performed by using connector J603. See Table 7-1 for specific pin measurements.

TABLE 7-1. CONNECTOR J603 ALIGNMENT CHECKS

Pin	Checking Procedure
A	Connect a 0 to +500 Vdc meter to this pin to monitor the voltage dropped across the high-voltage series regulator tube. Measurement will vary between 50 and 500 Vdc depending on the loading of the high-voltage supply and the ac input line voltage.
B	Connect a 0 to +200 Vdc, 10-k Ω /V meter to this pin to monitor the +150 Vdc regulated supply.
C	Connect a 0 to -100 Vdc, 10-k Ω /V meter to this pin to monitor the -85 Vdc regulated supply.
D & E	Connect a -200 to 0 to +200 Vdc, 20-k Ω /V meter between these two pins to monitor the balance of the differential amplifier composed of tubes V107 and V108.
F	Connect 0 to -200 Vdc, 10-k Ω /V meter to this pin to monitor the -150 Vdc regulated supply.
J & K	Connect these pins together during initial alignment of the power supply; when connected together, potentiometer R134 is set to balance the output of differential amplifier tube V107.

SECTION VIII

TROUBLESHOOTING

Troubles found during operation or checkout of the AILTECH 445 Power Oscillator can usually be isolated to a particular subassembly or component by making the following simple voltage or waveform measurements. Servicing personnel should be thoroughly familiar with the AILTECH 445 Power Oscillator and its operation, as described in Sections I through V before trying to troubleshoot the equipment. Most common troubles can be corrected by properly adjusting the system components as detailed in Section VI.

8-1. MODULATOR

All dc voltage measurements on the modulator are shown in Table 8-1 and were made using a 20-k Ω /V meter at a power output setting of 7 watts. All voltage measurements are referenced to pin F of J503.

WARNING

Pin F of J503 is the high-voltage lead.

8-2. PROTECT CIRCUIT

All dc voltages are shown in Table 8-2 and were made using a 20-k Ω /V meter.

8-3. POWER SUPPLY

Power supply voltage measurements are shown in Table 8-3 and were measured with a vacuum tube voltmeter. Measurements on V107 and V108 were made with pins 2 and 7 of V108 shorted together, K103 removed, and the RF POWER OUTPUT ADJ control set for a reading of -3.0 volts on pins 2 and 7 of V108. Measurements on the rest of the power supply were made with the jumper removed and the RF POWER OUTPUT ADJ control set for a reading of -500.0 volts on terminal 1 of R141. All voltage measurements are referenced to chassis ground.

8-4. MULTIVIBRATOR

An oscilloscope with a high-frequency plug-in unit is used to measure waveforms for the multivibrator. Figure 8-1 shows approximate waveforms. Measurements were made with PULSE SHAPE switch in 1-kHz position.

TABLE 8-1. MODULATOR VOLTAGE MEASUREMENTS

*****WARNING*****

The following measurements were referenced to J503 pin F, which is connected to the high-voltage power supply.

Component	Test Location	Meter Reading (Vdc)
Q501	Base	- 1.0
	Emitter	+ 0.37
	Collector	+16.5
Q502	Base	+30.0
	Emitter	+30.75
	Collector	+18.0

TABLE 8-2. PROTECTIVE CIRCUIT MEASUREMENTS

NOTE

All voltage measurements referenced to chassis ground. Voltage measurements made with zero reflected power from directional coupler.

Component	Test Location	Meter Reading (+Vdc)
Q801	Base	4.6
	Emitter	4.0
	Collector	17.5
Q802	Base	3.2
	Emitter	4.0
	Collector	23.0
Q803A	Base	5.6
	Emitter	5.4
	Collector	5.6
Q803B	Base	5.2
	Emitter	5.4
	Collector	24.0

TABLE 8-3. POWER SUPPLY VOLTAGE MEASUREMENTS

Component	Test Location	Meter Reading (Vdc)
V102	Pin 1	-149.0
	Pin 2	-148.0
	Pin 5	-18.0
	Pin 6	-85.0
	Pin 7	-148.0
V103	Pin 1	-21.0
	Pin 2	about +175.0
	Pin 3	about +0.4
	Pin 4	-21.0
	Pin 5	about +175.0
	Pin 6	about +0.4
V104	Pin 1	+149.0
	Pin 2	0
	Pin 4	0
	Pin 5	+149.0
	Pin 7	0
V105	Pin 1	0
	Pin 2	-149.0
	Pin 4	-149.0
	Pin 5	0
	Pin 7	-149.0
V106	Pin 1	0
	Pin 2	-85.0
	Pin 4	-85.0
	Pin 5	0
	Pin 7	-85.0
V107*	Pin 1	+215.0
	Pin 2	+42.0
	Pin 3	+43.5
	Pin 6	+215.0
	Pin 7	+43.0
	Pin 8	+43.5
V108*	Pin 1	+42.0
	Pin 2	-3.0
	Pin 3	-2.0
	Pin 6	+42.0
	Pin 7	+3.0
	Pin 8	-2.0

* Measurements on V107 and V108 were made with pins 2 and 7 of V108 shorted together, K103 removed, and the POWER knob set for a reading of -3.0 volts on pins 2 and 7 of V108.



A. JUNCTION OF R501 AND C501



E. COLLECTOR OF Q502



B. BASE OF Q501



F. PIN 6 OF V101



C. COLLECTOR OF Q501



G. PIN 1 OF V101



D. BASE OF Q502



H. PIN 3 OF V101

FIGURE 8-1. APPROXIMATE WAVEFORMS FOR MULTIVIBRATOR

SECTION IX

ELECTRICAL PARTS LIST

This section lists all replaceable electronic components used in the AILTECH 445 Power Oscillator (including plug-in modules), except for the Model 1926 and Model 1927 switchable racks (these are listed in Section 12). Table 9-1 lists the vendor codes from the Federal Cataloging Handbook H4-2. Table 9-2 lists AILTECH 445 parts, Table 9-3 is a list of recommended spare parts, and Tables 9-4 through 9-11 list the plug-in module parts. The vendor code numbers also appear in the "Vendor" column of the tables and identify the manufacturer whose part number appears there. All components that are available commercially are marked "Com'l." The tables are arranged in alpha-numeric order by "Symbol" number (which appears on the appropriate schematic in the Appendix. The physical location of the components can be found by referring to the figure number listed in the "Figure" column, except those shown with a hyphen (-). Figures 9-1 through 9-5 are located at the end of this section.

An exact equivalent may be substituted for any part listed. Purchased parts may be obtained directly from vendors, or they may be supplied by AILTECH after receiving an order specifying the AILTECH 445, plug-in module model number, or switchable rack model number (Model 1926 or 1927), and the symbol number for each part ordered to ensure positive identification of parts. These parts should be ordered from:

AILTECH West Coast Operation
19535 East Walnut Drive
City of Industry, California 91748
Telephone: (213) 965-4911
TWX: 910-584-1811

TABLE 9-1. VENDOR CODES

Code No.	Name and Address
01121	Allen-Bradley Co., Milwaukee, Wisc.
02660	Amphenol Corp., Chicago, Ill.
04713	Motorola, Inc. Semiconductor Products Div., Phoenix, Ariz.
05245	Corcom Inc., Chicago, Ill.
05571	Sprague Electric Co., Pacific Div., Los Angeles, Calif.
07263	Fairchild Semiconductor Corp., Palo Alto, Calif.
08806	General Electric Co., Miniature Lamp Dept., Cleveland, Ohio
12060	Diodes, Inc., Canoga Park, Calif.
12678	AILTECH West Coast Operations, 19535 E. Walnut Dr., City of Industry, Calif.
14355	National Lead Ind., Hightstown, N.J.
14752	Electro Cube, Inc., Pasadena, Calif.
15584	Riedon Div., Onmark Eng. Co., North Hollywood, Calif.
15605	Cutler-Hammer, Inc., Milwaukee, Wisc.
15818	Teledyne Co., Amelco Semiconductor Div., Mountain View, Calif.
16017	KGS Electronics, Pasadena, Calif.
16758	Delco Radio Div. of General Motors Corp., Kokomo, Ind.
24446	General Electric Co., Schenectady, N.Y.
37942	P. R. Mallory & Co., Indianapolis, Ind.
44655	Ohmite Manufacturing Co., Skokie, Ill.
58474	Superior Electric Co., Bristol, Conn.
62619	Dialight Corp., Brooklyn, N.Y.
63060	Victoreen Instrument Div., Victoreen Inc., Cleveland, Ohio
70563	Amperite Co., New York, N.Y.
70903	Belden Manufacturing Co., Chicago, Ill.
71785	Cinch Manufacturing Corp., Chicago, Ill.
72136	Electro-Motive Mfg. Co., Willimantic, Conn.
72825	Hugh H. Eby Co., Philadelphia, Pa.
72982	Erie Technological Products, Inc., Erie, Pa.
75915	Littlefuse, Inc., Des Plaines, Ill.
76854	Oak Electro/Netics Corp., Crystal Lake, Ill.
78488	Stackpole Carbon Co., Johnsonburg, Pa.
80294	Bourns Laboratories, Inc., Riverside, Calif.
81312	Winchester Electronics Co., Inc., Norwalk, Calif.
82877	Rotron Manufacturing Co., Inc., Woodstock, N.Y.
87034	Marco-Oak Industries Co., Anaheim, Calif.
91637	Dale Electronics, Inc., Columbus, Nebr.
93929	G-V Controls Inc., Livingston, N.J.
95077	General R. F. Fittings Co., Boston, Mass.
96733	San Fernando Electric Manufacturing Co., San Fernando, Calif.
98278	Microdot Inc., Connector Div., South Pasadena, Calif.

TABLE 9-2. MODEL 445 PARTS LIST

Symbol	Figure	Description	Part No.	Vendor
B401	9-2	Fan, Muffin, Venturi		82877
C101	9-1	Cap., 330 pF, 500 V	CM-15-E-331J	Com'l
C102	9-1	Cap., 330 pF, 500 V	CM-15-E-331J	Com'l
C103	9-1	Cap., 0.05 μ F, 3 kV, $\pm 20\%$	520-BIL-503	14752
C104	9-2	Cap., 4 μ F, 1.5 kV	CP07E1EH405K	05571
C105	9-2	Cap., 100 μ F, 450 Vdc	500-1126-01	00853
C106	9-2	Cap., 100 μ F, 450 Vdc, $\pm 50\%$, -10%	HC45001	37942
C107	9-2	Cap., 100 pF, 500 V, $\pm 5\%$	CM-20-B-101J	Com'l
C108	9-1	Cap., 3 pF, 500 V, $\pm 25\%$	301-C0J-309C	72982
C109	-	Cap., 25 μ F, 2 kV, $\pm 10\%$	CP70E1EJ254K	Com'l
C110	9-1	Cap., 0.05 μ F, 2 kV, 20%	520B	14752
C111	-	Cap., 1 μ F, 200 V, $\pm 20\%$	25M105A	96733
C113	-	Cap., 100 μ F, 15 V	TE 1162	05571
C114	-	Cap., 1 μ F, 100 V	141A1B105M	14752
C115	-	Cap., 50 μ F, 50 V	TE 1307	05571
C501	9-4	Cap., 0.05 μ F, 2 kV, $\pm 20\%$	520B503M	14752
C502	9-4	Cap., 27 pF, 500 V, $\pm 5\%$	CM-15-E-270J	72136
C503	9-4	Cap., 470 pF, 300 V, $\pm 5\%$	CM-15-E-471J	72136
C504	9-4	Cap., 160 pF, 500 V, $\pm 5\%$	CM-15-E-161J	72136
C505	9-4	Cap., 1 μ F, 100 V, $\pm 20\%$	141A	14752
C506	9-4	Cap., 1 μ F, 100 V, $\pm 20\%$	141A	14752
C601	-	Cap., 47 μ , 35 V	K47J35K	05397
C801	-	Cap., 1000 pF	1201-052	72982
C802	-	Cap., 1000 pF	1201-052	72982
C803	-	Cap., 1000 pF	1201-052	72982
C804, 6	-	Cap., 6.8 μ F, 35 V, $\pm 10\%$	150D685X9035B2	05571
C805	-	Cap., .1 μ F, 35 V, $\pm 10\%$	TS1K-35-104K	17554
C807	-	Cap., 15 pF, 1000 V. $\pm 10\%$	5GA-015	05571
C808, 9, 10	-	Cap., 1000 pF	1201-052	72982
CR101	9-1	Bridge	BR-830A	12060
CR102	9-1	Diode	MDA 922-8	04713
CR103	9-1	Diode	MDA 922-8	04713
CR104	9-1	Diode	1N3030B	Com'l
CR501	9-4	Diode	1N2990B	Com'l
CR502	-	Diode	1N5240	04713

TABLE 9-2. (Continued)

Symbol	Figure	Description	Part No.	Vendor
CR601	-	Diode	1N457	Com'l
CR602	-	Diode	1N751	Com'l
CR603	-	Diode	1N457	Com'l
CR604	-	Diode	1N457	Com'l
CR801	-	Diode	1N961	Com'l
CR802	-	Diode	1N961	Com'l
CR803	-	Diode	1N961	Com'l
CR804	-	Diode	1N457	Com'l
CR805	-	Diode	1N457	Com'l
CR806	-	Diode	1N457	Com'l
CR807	-	Diode	1N961	Com'l
CR808, 9	-	Diode	1N4148	Com'l
DS301	-	Lamp, Pilot	MC328	Com'l
DS302	-	Lamp, Pilot	MC327	Com'l
F101	-	Fuse	1/2A, 8AG	Com'l
F102	-	Fuse	1 AMP 8AG	Com'l
F103	-	Fuse	1 AMP 8AG	Com'l
F401	9-2	Fuse, Slo-Blo	3AG 4 AMP	Com'l
F401	(for 230 V only)	Fuse, Slo-Blo	3AG 2 AMP	Com'l
J401	-	Connector, Power Line	6EF2	
J501	9-4	Connector	UG911A	Com'l
J503	9-4	Connector	M10S-LSH19	81312
J603	-	Connector	M9S-LRN	02660
J701	-	Receptacle	57-10240	02660
K102	9-1	Relay, SPDT, 115 Vac	GHSIC2500VD	76854
K103	9-2	Time Delay Assembly	B851-8452	12678
K801	-	Relay	80GB4-4A-2.5K	72152
KRT101	-	Socket	8 EM	71785
L101	-	Inductor	B851-2922	12678
M301	9-1	Meter	B851-8307	12678

TABLE 9-2. (Continued)

Symbol	Figure	Description	Part No.	Vendor
P503	9-2	Connector	M10S-LSH19	81312
P802	-	Connector	M5P-LSH9	81312
Q501	9-4	Transistor	2N696	07263
Q502	9-4	Transistor	2N1131	07263
Q601	-	Transistor	MFE3001	04713
Q602	-	Transistor	MPS6531	04713
Q603	-	Transistor	MPS6534	04713
Q801	-	Transistor	2N3 921	15818
Q802	-	Transistor	MPS6531	04713
Q803	-	Transistor	MPS6534	04713
Q804	-	Transistor	MPS6531	04713
R100	9-1	Res., 2.5 k, 5 W, $\pm 5\%$, ww	243E2525	05571
R101	9-1	Res., 150 k, $1/2$ W, 5%	RC20GF154J	Com'l
R102	9-1	Res., 1 k, $1/2$ W, $\pm 10\%$	RC20GF102K	Com'l
R103	9-1	Res., 3.92 M Ω , $1/2$ W, $\pm 1\%$	RN70B3924F	Com'l
R104	9-1	Res., 1.0 M Ω , $1/2$ W, 5%	RC20GF105J	Com'l
R105	-	Pot., 5 M Ω , $\pm 10\%$	RV6LAYSA505B	Com'l
R106	9-1	Res., 3.32 M Ω , $1/2$ W, $\pm 1\%$	RN70B3324F	Com'l
R108	9-1	Res., 1 k, $1/2$ W, $\pm 10\%$	RC20GF102K	Com'l
R109	9-1	Res., 68 k, $1/2$ W, $\pm 5\%$	RC20GF683J	Com'l
R110	9-1	Res., 33 k, 1 W, $\pm 5\%$	RC32GF333J	Com'l
R115	9-1	Res., 470 k, 2 W, $\pm 10\%$	RC42GF474K	Com'l
R116	9-1	Res., 470 k, 2 W, $\pm 10\%$	RC42GF474K	Com'l
R117	9-1	Res., 330 k, $1/2$ W, $\pm 10\%$	RC20GF334K	Com'l
R118	9-1	Res., 330 k, $1/2$ W, $\pm 10\%$	RC20GF334K	Com'l
R119	9-1	Res., 18 k, 5 W, 3%	RS5W	91637
R120	9-1	Res., 7.5 k, 5 W, 3%	RS5W	91637
R121	-	Pot., 10 k, $1/2$ W, $\pm 5\%*$	RV6LAYSA103A	Com'l
R122	9-1	Res., 1 k, $1/2$ W, $\pm 10\%$	RC20GF102K	Com'l
R123	-	Res., 1 k, $1/2$ W, $\pm 10\%$	RC20GF102K	Com'l
R124	9-1	Res., 15 k, 1 W, $\pm 5\%$	RC32GF153J	Com'l
R125	9-1	Res., 100 k, $1/2$ W, $\pm 5\%$	RC20GF104J	Com'l
R126	9-1	Res., 100 k, $1/2$ W, $\pm 5\%$	RC20GF104J	Com'l
R127	9-1	Res., 100 k, $1/2$ W, $\pm 5\%$	RC20GF104J	Com'l
R128	9-1	Res., 240 k, $1/2$ W, 5%	RC20GF243J	Com'l
R129	9-1	Res., 390 k, $1/2$ W, $\pm 5\%$	RC20GF394J	Com'l
R130	9-1	Res., 27, $1/2$ W, $\pm 5\%$	RC20GF270J	Com'l
R131	9-1	Res., 27, $1/2$ W, $\pm 5\%$	RC20GF270J	Com'l

*Slot Shaft

TABLE 9-2. (Continued)

Symbol	Figure	Description	Part No.	Vendor
R132	9-1	Res., 1 k, 1/2 W, $\pm 10\%$	RC20GF102K	Com'l
R133	9-1	Res., 1 k, 1/2 W, $\pm 10\%$	RC20GF102K	Com'l
R134	-	Pot., 1 k, 1/2 W, $\pm 10\%$	RV6LAYSA102A	Com'l
R135	9-1	Res., 182 k, 1/2 W, $\pm 10\%$	RN70B1823F	Com'l
R136	9-1	Res., 182 k, 1/2 W, $\pm 10\%$	RN70B1823F	Com'l
R137	-	Pot., 100 k, 1/2 W, $\pm 5\%$, ww	RV6LAYSA104A	Com'l
R138	9-1	Res., 1 M Ω , 2 W, $\pm 1\%$	RN80B1004F	Com'l
R139	9-1	Res., 121 k, 1/2 W, $\pm 1\%$	RN70B1213F	Com'l
R140	9-1	Res., 47 k, 1/2 W, $\pm 5\%$	RC20GF473J	Com'l
R141	9-1	Res., 50 k, 50 W, $\pm 3\%$, ww	RH506503F	91637
R142	9-1	Res., 1 M Ω , 1/2 W, 5%	RC20GF105J	Com'l
R148	9-1	Res., 12 k, 20 W, 3%, ww	HG-10-12K-3%	91637
R149	9-1	Res., 27 k, 20 W, 3%, ww	HG-10-27K-3%	91637
R150	9-1	Res., 6.8 k, 35 W, 3%, ww	HG-25-6.8K-3%	91637
R151	9-1	Res., 1.5 k, 1/4 W, 5%	RC07GF152J	Com'l
R152	9-1	Res., (nominal 100, 1 W)	Selected Val.	Com'l
R153	-	Res., 27, 1/2 W, $\pm 5\%$	RC20GF270J	Com'l
R154	-	Res., 62 k, 1/2 W, $\pm 5\%$	RC20GF623J	Com'l
R155	-	Res., 5.1 k, 1/2 W, $\pm 5\%$	RC20GF512J	Com'l
R156	-	Pot., 2 M Ω , .75 W, $\pm 10\%$	3006P- 1-205	80294
R157	-	Res., 100, 1/4W, 5%	RC07GF101J	Com'l
R203	9-2	Pot., modified	A851-7584-1	12678
R501	9-4	Res., 4.7 k, 1/2 W, $\pm 5\%$	RC20GF472J	Com'l
R502	9-4	Res., 4.7 k, 1/2 W, $\pm 5\%$	RC20GF472J	Com'l
R503	9-4	Res., 330, 1/2 W, $\pm 5\%$	RC20GF331J	Com'l
R504	-	Res., 1.2K 1/4W, 5%	RC20GF122J	Com'l
R505	9-4	Res., 100 k, 1/2 W, $\pm 5\%$	RC20GF104J	Com'l
R506	9-4	Res., 2.2 k, 1/2 W, $\pm 5\%$	RC20GF222J	Com'l
R507	9-4	Res., 2.2 k, 1/2 W, $\pm 5\%$	RC20GF222J	Com'l
R508	9-4	Res., 390, 1/2 W, $\pm 5\%$	RC20GF391J	Com'l
R509	9-4	Pot., 500, 1/2 W, ww	W0117	44655
R601	-	Res., 30 k, 1/4 W, 5%	RC07GF303J	Com'l
R602	-	Res., 27, 1/4 W, 5%	RC07GF270J	Com'l
R603	-	Res., 820 k, 1/4 W, 5%	RC07GF824J	Com'l
R604	-	Res., 4.3 k, 1/4 W, 5%	RC07GF432J	Com'l
R605	-	Res., 4.3 k, 1/4 W, 5%	RC07GF432J	Com'l
R606	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R607	-	Res., 30 k, 1/4 W, 5%	RC07GF303J	Com'l
R608	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R609	-	Res., 300 k, 1/4 W, 5%	RC07GF304J	Com'l

TABLE 9-2. (Continued)

Symbol	Figure	Description	Part No.	Vendor
R610	-	Res., 2.2 k, 1/4 W, 5%	RC07GF222J	Com'l
R611	-	Res., 2.2 k, 1/4 W, 5%	RC07GF222J	Com'l
R612	-	Res., 2.4 k, 1/4 W, 5%	RC07GF242J	Com'l
R613	-	Res., 10 k, 1/4 W, 5%	RC07GF103J	Com'l
R801	-	Res., 1 k, 1/4 W, 5%	RC07GF102J	Com'l
R802	-	Res., 100 k, 1/4 W, 5%	RC07GF104J	Com'l
R803	-	Res., 15 k, 0.08 W, 1%, ww	SM-3-14K-1%	15584
R804	-	Res., 15 k, 0.08 W, 1%, ww	SM-3-14K-1%	15584
R805	-	Res., 30 k, 0.08 W, 1%, ww	SM-3-30K-1%	15584
R806	-	Pot., 20 k	3280W-1-203	80294
R807	-	Res., 30 k, 0.08 W, 1%, ww	SM-3-30K-1%	15584
R808	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R809	-	Res., 10 k, 1/4 W, 5%	RC07GF103J	Com'l
R810	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R811	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R812	-	Res., 51 k, 1/4 W, 5%	RC07GF513J	Com'l
R813	-	Res., 30 k, 1/4 W, 5%	RC07GF303J	Com'l
R814	-	Res., 4.7 k, 1/4 W, 5%	RC07GF472J	Com'l
R815	-	Res., 2.4 k, 1/2 W, 5%	RC20GF242J	Com'l
R816	-	Res., 100, 1/4 W, 5%	RC07GF101J	Com'l
RT101	9-2	Ballast Lamp	12-3H	70563
RT102	-	Thermistor	3D304	14355
S301	-	Switch, Toggle	NAS543-2	Com'l
S302	9-1	Switch	SS-26-1	78488
S303	9-1	Switch	SS-72-1	78488
S304	-	Pushbutton Switch	192-0105-1471-604	62619
S401	-	Switch, Slide (115 V - 230 V)	28-64600-0	12678
S501	9-4	Pos., Shorting Switch	222812-F2X	76854
T101	-	Transformer	1383T	16017
T102	9-2	Transformer	B12099	12678
T201	9-2	Transformer, Var.	10B	58474
V101	-	Tube	6U8/6U8A	24446
V102	-	Tube	6AU6A	Com'l
V103	-	Tube	6528	Com'l
V104	-	Tube	0A2	Com'l
V105	-	Tube	0A2	Com'l
V106	-	Tube	5651WA	Com'l
V107	-	Tube	5751	Com'l
V108	-	Tube	5751	Com'l

TABLE 9-2. (Continued)

Symbol	Figure	Description	Part No.	Vendor
XF101	-	Fuseholder	387-001	75915
XF102	-	Fuseholder	387-001	75915
XF103	-	Fuseholder	387-001	75915
XF401	9-2	Fuseholder	34-2004	75915
XV101	-	Socket	9713-203	72825
XV102	-	Socket	9727-77	72825
XV103	9-2	Socket	8-EM	71785
XV104	-	Socket	9727-77	72825
XV105	-	Socket	9727-77	72825
XV106	-	Socket	9727-77	72825
XV107	-	Socket	9713-203	72825
XV108	-	Socket	9713-203	72825

TABLE 9-3. AILTECH 445 RECOMMENDED SPARE PARTS LIST

Symbol	Figure	Description	Part No.	Vendor
F101	-	Fuse	1/2A, 8AG	Com'l
F401	9-2	Fuse, Slo-Blo	3AG 4 AMP	Com'l
K102	9-1	Relay SPDT, 115 Vac	GHSIC2500VD	76854
V1	-	Tube, UHF Triode	A856-5018	12678
V101	-	Tube	6U8/6U8A	24446
V102	-	Tube	6AU6A	Com'l
V103	-	Tube	6528	Com'l
V104	-	Tube	0A2	Com'l
V105	-	Tube	0A2	Com'l
V106	-	Tube	5651WA	Com'l
V107	-	Tube	5751	Com'l
V108	-	Tube	5751	Com'l

TABLE 9-4. COMMON PARTS LIST FOR ALL PLUG-IN MODULES.

Symbol	Figure	Description	Part No.	Vendor
CR701	9-3	Diode	1.5M6.8Z	04713
DS701	9-3	Lamp, 6-8 V	#51	Com'1
P601	9-3	Connector	M4P-H10	81312
P701	9-3	Connector	57-20240	02660
Q701	9-3	Transistor	2N5679	16758
R145	9-3	Pot., 10	3255W-66-100	80294
R702	9-3	Pot., 200	3255W-66-201	80294
R703	9-3	Res., 75, 1/2 W, 5%	RC20GF750J	Com'1
R704	9-3	Pot., 20 k	3299X-1-203	80294
R705	9-3	Pot., 20 k	3299X-1-105	80294
R706	9-3	Pot., 1 M Ω	RC07GF102J	Com'1
R707	9-3	Res., 1 k, 1/4 W, 5%	A856-5018	12678
	-	Tube, UHF Triode		

TABLE 9-5. PARTS LIST FOR MODEL 183 PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	7-0	Directional Coupler	C856-5298-0	12678
R114	7-0	Res., 45, Nominal, 2 W, 5%	Selected Val.	Com'l
R146	7-0	Res., 100, 1 W, 5%	RC32GF101J	Com'l
R510	7-0	Res., 75, 10 W, WW	247E7505	05571
R702	7-0	Pot., 200, 1 W	3280L-1-201	80294
R708	7-0	Res., 5.6 k, 1/2 W, 5%	RC20GF562J	Com'l
R709	7-0	Res., 200, 2 W, 5%	RC42GF201J	Com'l
R710	7-0	Res., 200, 2 W, 5%	RC42GF201J	Com'l
R711	7-0	Res., 200, 2 W, 5%	RC42GF201J	Com'l
R712	7-0	Res., 200, 2 W, 5%	RC42GF201J	Com'l
S701	7-0	Switch 2 Pol., 6 Pos.	PA-2003	71590
C701	7-0	Cap., Var., 11.6-200 pF	167-12	74970
C702	7-0	Cap., Var., 11.6-200 pF	167-12	74790
C703	7-0	Cap., Var., 4-50 pF	167-3	74790
Q701	7-0	Transistor	MJE-340	04713
CR701	7-0	Diode, Zener, 5.1 V, 10%	1N4733	04713

TABLE 9-6. PARTS LIST FOR MODEL 184 PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-1	12678
R113	9-3	Res., 180, 1/2 W, nominal	Selected Val.	Com'1
R114	9-3	Res., Test Select, 100, 1 W, nominal	Selected Val.	Com'1
R146	9-3	Res., 45, 3 W	RW59V450	91637
R510	9-3	Res., 75, 10 W	247E7505	05571

TABLE 9-7. PARTS LIST FOR MODEL 185 PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-2	12678
R113	9-3	Res., 50, 1/2 W, nominal	Selected Val.	Com'1
R114	9-3	Res., Test Select, 68, 1 W, nominal	Selected Val.	Com'1
R146	9-3	Res., 100, 1 W, 5%	RC32GF101J	Com'1
R510	9-3	Res., 75, 10 W	247E7505	05571

TABLE 9-8. PARTS LIST FOR MODEL 186 PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-3	12678
R113	9-3	Res., 33, 1/2 W, nominal	Selected Val.	Com'1
R114	9-3	Res., 47, 1 W, nominal	RC32GF470J	Com'1
R146	9-3	Res., 100, 1 W, 5%	RC32GF101J	Com'1
R510	9-3	Res., 75, 10 W	247E7505	05571

TABLE 9-9. PARTS LIST FOR MODEL 187 PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-4	12678
R113	9-3	Res., 100, 1/2 W, nominal	Selected Val.	Com'1
R114	9-3	Res., Test Select, 39, 1 W, nominal	Selected Val.	Com'1
R146	9-3	Res., 100, 1 W, 5%	RC32GF101J	Com'1
R510	9-3	Res., 75, 10 W	247E7505	05571

TABLE 9-10. PARTS LIST FOR MODEL 188A PLUG-IN MODULE.

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-1	12678
R113	9-3	Res., 0 Ω , nominal	Selected Val.	Com'1
R114	9-3	Res., 36, 1 W, nominal	RC32GF470J	Com'1
R146	9-3	Res., 100, 1 W, 5%	RC32GF101J	Com'1
R147	-	Res., Test Select	Selected Val.	91637
R148	-	Res., Test Select	Selected Val.	91637
R510	9-3	Res., 39, 3 W	242E3905	05571

TABLE 9-11. PARTS LIST FOR MODEL 189A PLUG-IN MODULE

Symbol	Figure	Description	Part No.	Vendor
DC701	9-3	Directional Coupler	C856-5298-6	12678
R113	9-3	Res., 0 Ω , nominal	Selected Val.	Com'1
R114	9-3	Res., 33, 1 W, nominal	RC32GF470J	Com'1
R146	9-3	Res., 100, 1 W, 5%	RC32GF101J	Com'1
R147	-	Res., Test Select	Selected Val.	91637
R148	-	Res., Test Select	Selected Val.	91637
R510	9-3	Res., 50, 1 W	242E5005	05571

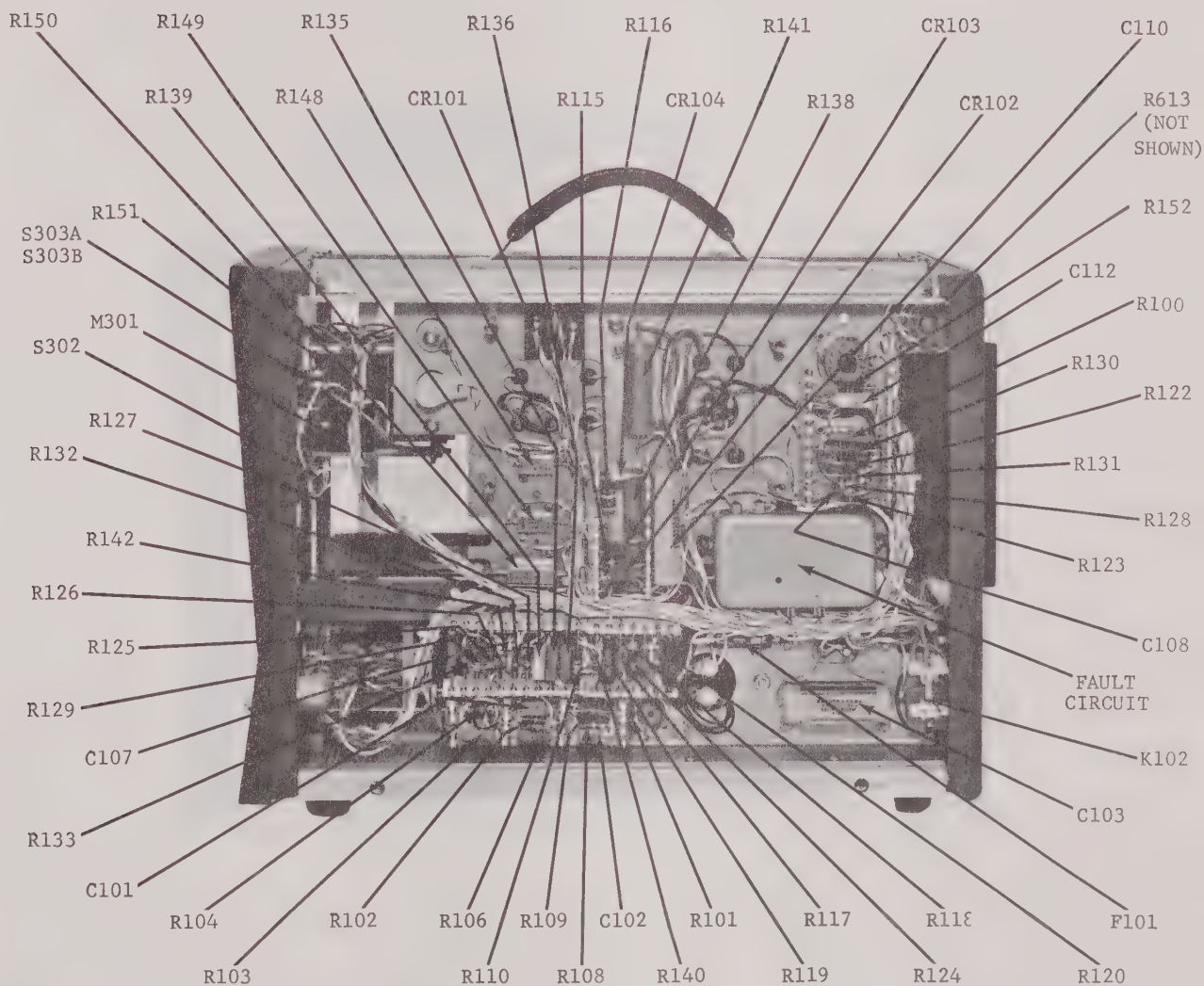


FIGURE 9-1. RIGHT SIDE VIEW - COVER REMOVED

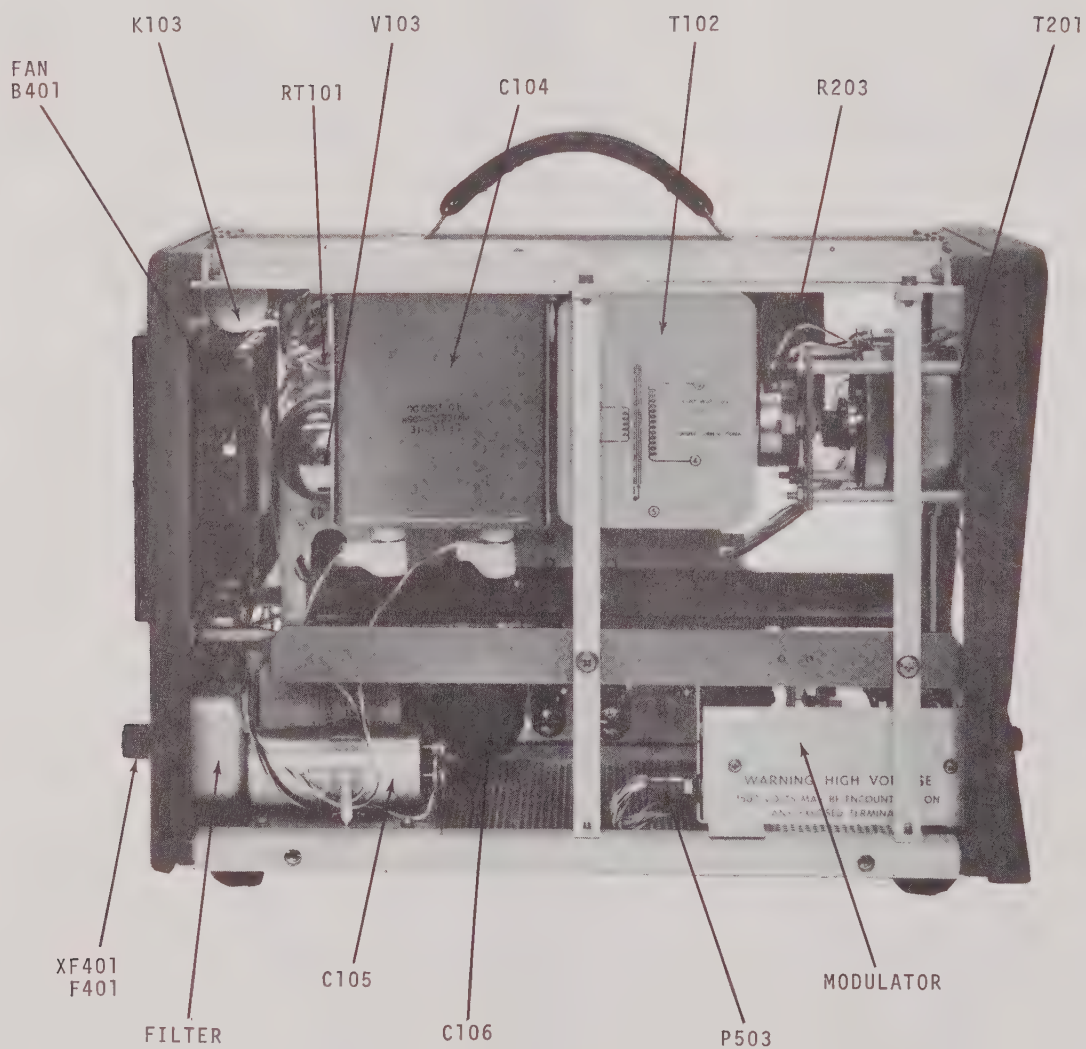


FIGURE 9-2. LEFT SIDE VIEW - COVER REMOVED

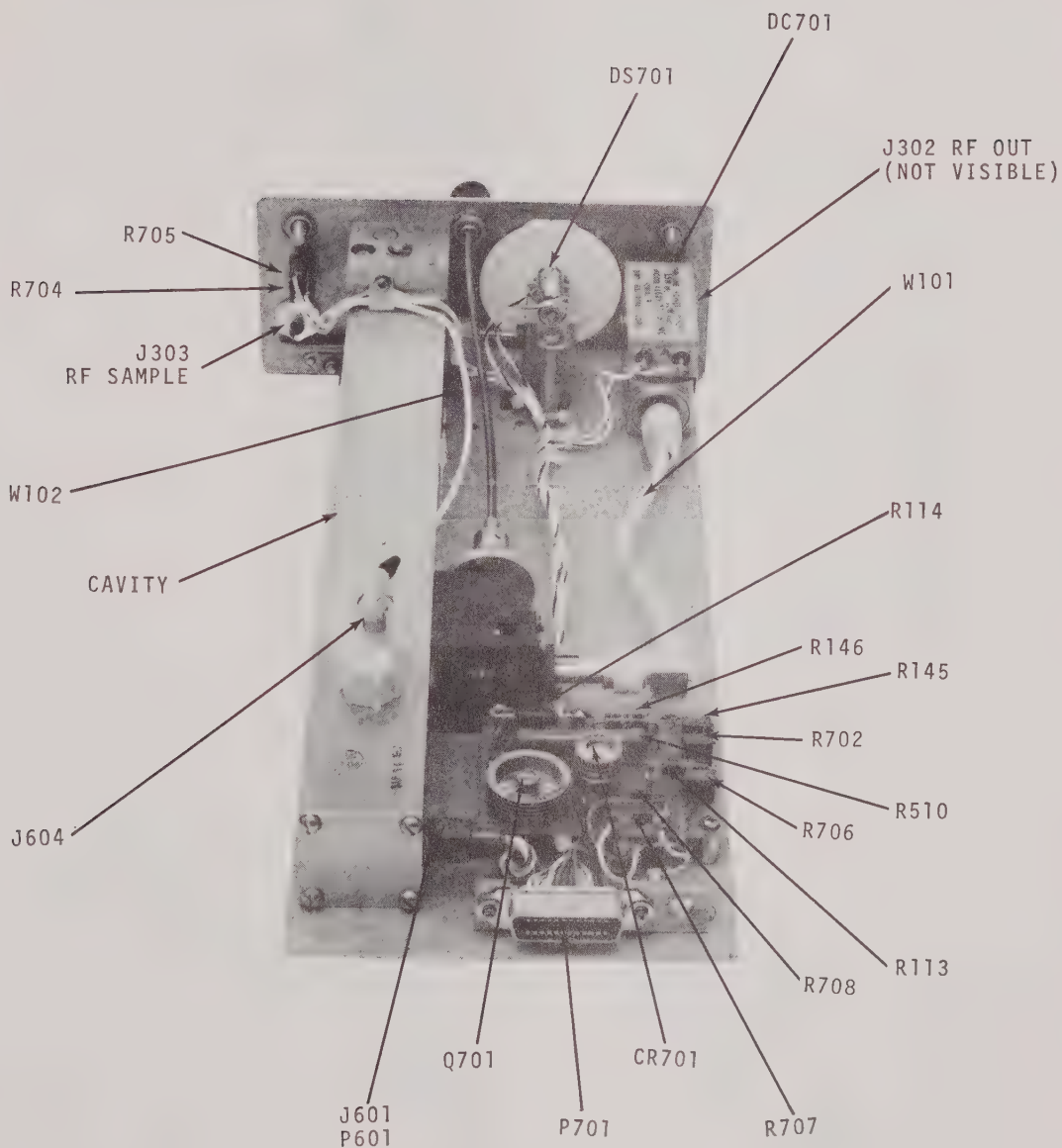
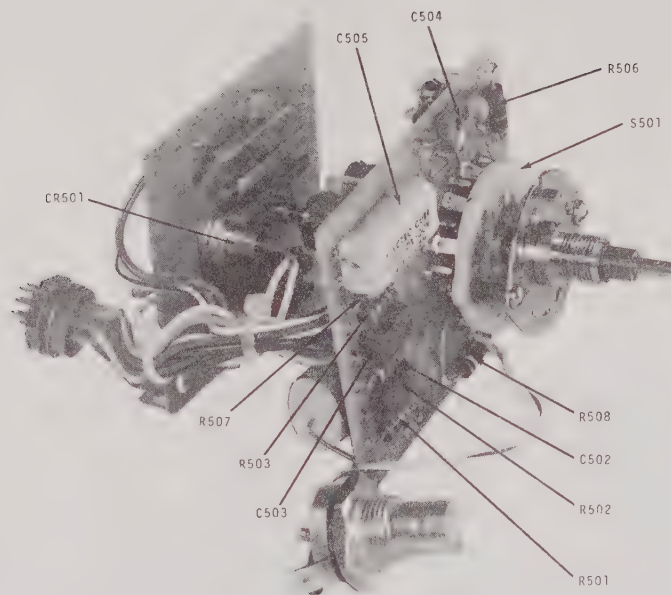
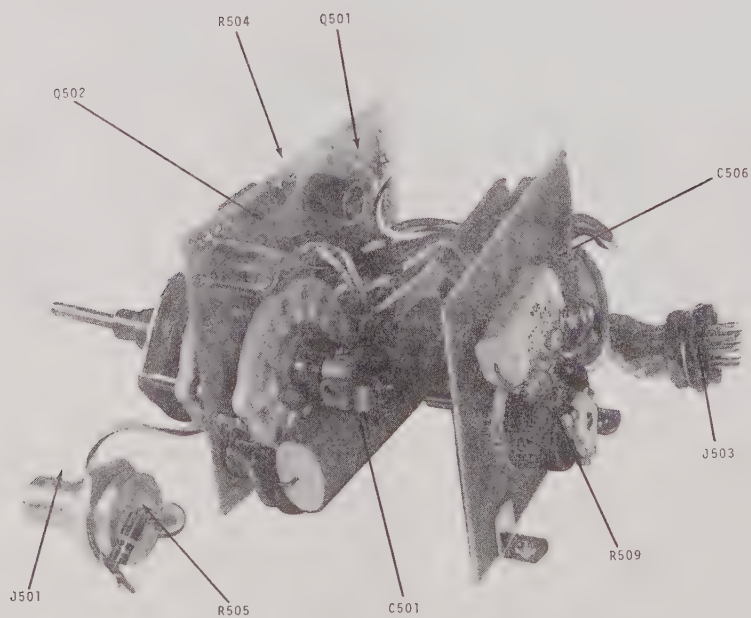


FIGURE 9-3. PLUG-IN MODULE

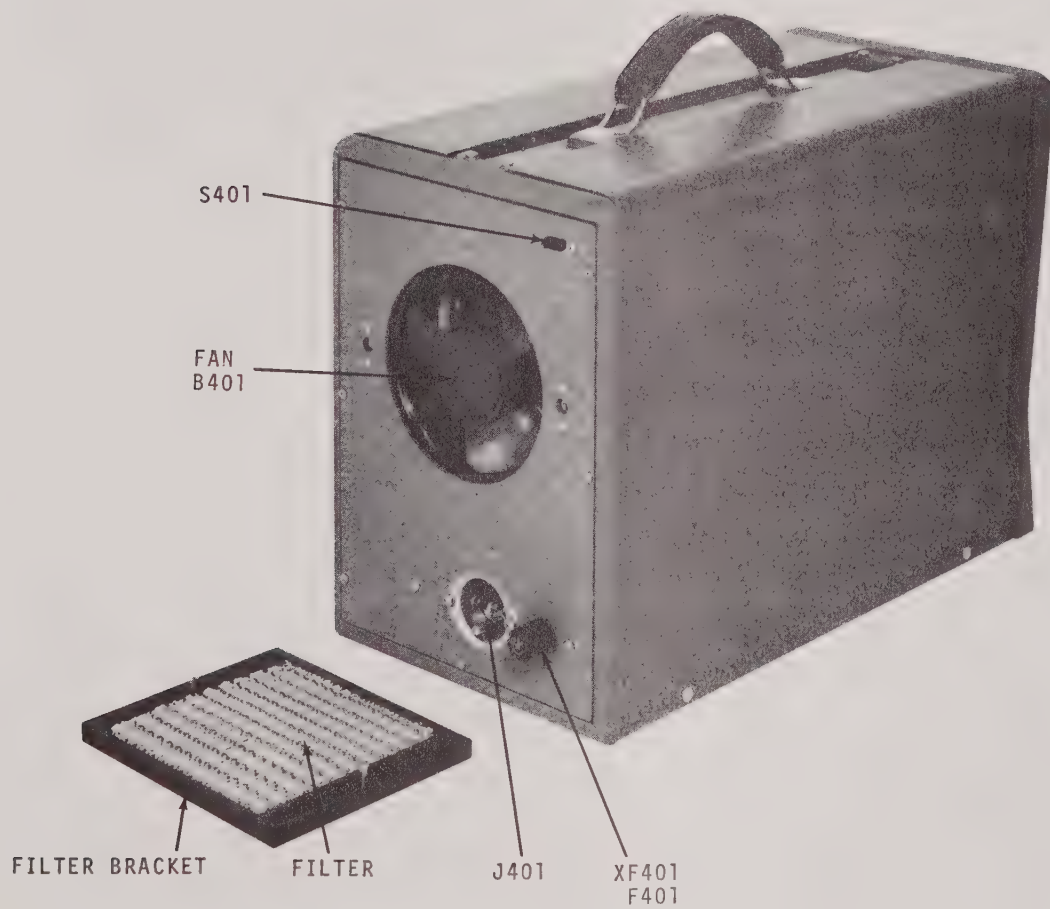


A. RIGHT SIDE - CHASSIS REMOVED



B. LEFT SIDE - CHASSIS REMOVED

FIGURE 9-4. MODULATOR ASSEMBLY



2-2605

FIGURE 9-5. REAR PANEL

SECTION X

AM OPTION - DASH 1 CONFIGURATION

10-1. SPECIFICATIONS

Models 183 through 189A plug-in modules are available with amplitude modulation as an option. When so modified, they assume the Model Number 183-1 through 189A-1, respectively. The specifications peculiar to these units are as follows: modulation frequency range and response is less than 3 dB variation for 300 Hz to 20 kHz. Modulation input level is a maximum of 23 V rms into 16 ohms for 100 percent AM. Peak power is limited to maximum CW ratio of unit. These specifications are in addition to those listed in Table 2-1.

The AM circuitry is as shown on Figure A-3 in the Appendix. The secondary winding of the modulation transformer T1 is connected in series with the high voltage so that ac voltages applied to the primary winding (through jack J1) are stepped up and added (algebraically) to the high voltage. This modulates the carrier output level of the power oscillator in accordance with the modulation range.

The voltage on the load side of the secondary winding is equal to the high voltage dc, plus and minus the modulation peak voltages (stepped up by the transformer). If this voltage exceeds 1200 V, tube V1 conducts with a constant voltage drop of 1200 V. The excess voltage appears across resistor R2 and is applied to the protective circuit module (see paragraph 4-10) along with the reflected power signal from the directional coupler DC701, to turn off the high voltage. To avoid damaging the protective circuit components in the brief interval between reaching 1200 V and actual turnoff, resistor R1 and diode CR1 limit the voltage across diode CR1 to its barrier potential of about 0.6 V. Thus, the maximum voltage applied to the protective circuit is 0.6 V.

NOTE

When operating Dash 1 (AM) units in the CW or FM modes, be certain to terminate the AM input connector with a short or 16-ohm impedance. Failure to do so may result in parasitic oscillations under certain operating conditions. A short is provided as part of the unit.

For 100-percent modulation, the maximum unmodulated carrier level possible is one-quarter the maximum rated power. This limits the peak power to the maximum rated power. Higher average powers are possible for lesser percentages of modulation. If the unit is inadvertently overmodulated, the fault circuit will activate. The operation is restored by depressing the READY/RESET lamp.

The percentage of AM can be conveniently measured, using an oscilloscope and a diode detector connected to the RF sample output.

$$\text{Percentage of AM} = \frac{\text{AC}}{2 \times \text{DC}} \times 100$$

where

AC = PP value of detected signal as measured on scope.

DC = DC level of detected signal as measured on scope.



TABLE 10-1. PARTS LIST FOR AM PLUG-IN MODULES

The parts list for the AM-type plug-in modules is the same as for the standard plug-in modules (see Tables 9-4 through 9-11) except for the addition of the following items.

Symbol	Part Number	Description	Vendor
CR1	1N457	Diode	Com'l
J1	31-50	Connector	98278
R1	RC20GF473	Res., 47 k, 1/2 W, 5%	Com'l
R2	RC20GF105J	Res., 1 meg, 1/2 W, 5%	Com'l
T1	985T	Transformer	16017
V1	GV3A1200	Tube	63060

SECTION XI

FM OPTION - DASH 2 CONFIGURATION

11-1. SPECIFICATIONS

Models 184 through 189A plug-in modules are available with frequency modulation capability as an option. When so modified, they assume the model numbers 184-2 through 189A-2, respectively. The specifications peculiar to these units are given below. (They are in addition to the specifications listed in Table 2-1.) Modulation input level is up to 15 V rms for models 184, 185 and 186, and up to 7.5 V rms for models 187 through 189A. The equipment shall not be damaged by a momentary external audio input of 40 V rms. The modulation frequency range is 10 Hz to 100 kHz. Deviation is as shown on the following list:

Model Number	Frequency Range (MHz)	Deviation* P-P (kHz) Min
184-2	10-30 30-50	25
185-2	50-100 100-200	25-60 60-80
186-2	200-400 400-500	70-90
187-2	500-1000	100-200
188A-2	1000-2000	200
189A-2	2000-2500	200

* Greater deviation possible on special request - contact factory.

11-2. CIRCUIT DESCRIPTION

Figure A-2 in the Appendix shows the schematic for the typical plug-in oscillator module including the optional FM circuitry. The heart of this frequency modulation technique is the pair of varactor diodes CR801 and CR802. These are capacitively coupled to the plate tank circuit and are effectively in parallel as far as the RF voltage is concerned.

The function of the varactor is to change its capacitance in relationship to the reverse bias voltage applied across it. This reverse voltage is obtained from two sources. Plus 27 V appearing at pins 23 and 24 of P701 is divided by resistors R801, R802 and R803 and applied to the diodes in series. In addition, the ac modulation component is fed in through J801, L801, C802 and C803 to combine with the dc component.

As the sum of these two voltages causes the varactor capacitance to change, the oscillator frequency changes accordingly. C801, L801 and C804 provide filtering to keep the RF voltage coupled to the diodes from leaking out the modulation jack. C802 and C803 provide dc isolation between the modulation source and the dc bias.

11-3. OPERATION

The FM-type plug-in modules can be used for CW power generation by operating according to Section V of this manual.

To produce FM, the modulation voltage (up to 10 V rms) is applied to the MOD IN jack J801. The amount of deviation will be directly proportional to the level of the modulation input voltage.

With Dash 2 configuration it is possible to frequency or phase lock the output to a crystal when used in conjunction with the AILTECH 1929 Synchronizer. It is still possible to frequency modulate the stabilized signal. Complete specifications and a detailed description are included in the AILTECH 1929 Instruction Manual.

Included on the plug-in module is a toggle switch, S801. When used with the synchronizer it should be switched to the AFS position.

Prime Specifications are as follows:

INPUTS:

Power	115 Vac, 1-1/2 A, maximum
RF	Sample of locked power source, 5 milliwatt maximum
AF	30 Hz to 1 MHz at a level of 1 V rms

OUTPUTS:

Control Signal	Consists of a dc component, which is between 0 and 30 Vdc, and the ac modulation component between 30 Hz and 1 MHz. This signal is applied to the frequency control element in the power source being frequency locked
Accuracy	When power source is frequency locked with the control signal from the synchronizer, its accuracy will be ± 0.0025 percent with an incidental FM of less than 1 part in 10^6

CONTROLS:

ON-OFF	Switch for application of primary power to unit
Modulation Amplitude	Allows for adjustment of modulation signal at the control signal output jack of between zero and 15 V, peak-to-peak

INDICATORS:

Power	Red pilot lamp which indicates primary power application to unit
Meters	One meter which indicates the error signal (control signal) being applied to the power source being frequency locked. One meter which indicates mixer crystal current

PHYSICAL:

Size	11 × 8 × 6 inches
Weight	15 pounds, maximum
Case	Self-contained, with carrying handle

TABLE 11-1. PARTS LIST FOR FM PLUG-IN MODULES

The parts list for the FM-type plug-in modules is the same as for the standard plug-in modules (see Tables 9-4 through 9-11) except for the addition of the following items.

Symbol	Part Number	Description	Vendor
C801	DM10-241J	240 pF Mica Capacitor	84171
C802	TE 1309	100 μ F Capacitor	05571
C803	TE 1309	100 μ F Capacitor	05571
C804	2930-000	240 pF Button Capacitor	72982
CR801	MV 1864B	Varactor Diode	04713
CR802	MV 1864B	Varactor Diode	04713
J801	31-51	Connector	98278
L801	SWD-6.8	Inductor	43543
R801	RC20GF562J	Res., 5.6 k, 1/2 W, 5%	Com'l
R803	RC20GF183J	Res., 18 k, 1/2 W, 5%	Com'l
S801	MST-205N	Switch, DPST	Alco

SECTION XII

AUXILIARY ITEMS

12-1. SWITCHABLE RACK MODELS 1926 AND 1927

The switchable racks (Figures A-6 and A-7 in the Appendix) are housings for the AILTECH 445 and three plug-in modules (Model 1926) or six plug-in modules (Model 1927). The switchable racks are composed of circuits that allow the Model 445 power supply to be switched to any one of the plug-in modules. This eliminates the need for inserting or removing plug-in modules during operation. The Model 1926 and Model 1927 are supplied with appropriate cooling fans.

Models 1926-1 and 1927-1 are for 230V operation.

12-2. SWITCHABLE RACK INSTALLATION

12-3. PARTS SUPPLIED

The following parts are supplied for installing the AILTECH 445 into the switchable rack.

<u>Part Number</u>	<u>Quantity</u>	<u>Part Name</u>
B851-5181	4	Mounting Bracket
NAS608C-832-8	4	Screw, No. 8-32 $\times$ 1/2, Socket-Head, Cap
NAS608C-832-6	4	Screw, No. 8-32 $\times$ 3/8, Socket-Head, Cap
MS 35333-72	8	Washer, No. 8, Lock

CAUTION

For proper ventilation of the AILTECH 445 when re-removed from the switchable rack, make sure the rubber feet are replaced on the AILTECH 445. Failure to replace rubber feet will result in damage to the unit.

CAUTION: When using models 1926-1 or 1927-1, the AILTECH 445 must be switched to 230V operation.

12-4. INSTALLATION PROCEDURE

If you receive the AILTECH 1926 or 1927 switchable rack without the AILTECH 445 Power Oscillator installed, follow these steps (while referring to Figure 12-1) to properly install the power oscillator into the switchable rack:

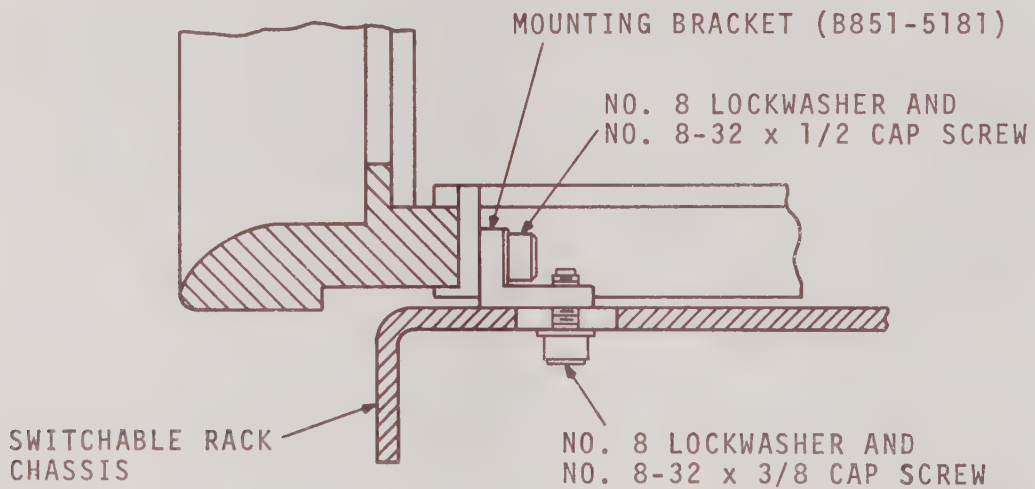


FIGURE 12-1. SWITCHABLE RACK INSTALLATION DETAIL

- a. Remove the bottom perforated cover of the AILTECH 445 by unscrewing the six holding screws (three from each bezel).
- b. Unscrew the No. 8-32 $\times$ 3/8 cap screws holding bottom side rails to bezel corners on the AILTECH 445.
- c. Install mounting bracket (part no. B851-5181) on the AILTECH 445 using a No. 8-32 $\times$ 1/2 cap screw and a No. 8 lockwasher.
- d. Repeat steps b and c to complete installation of four mounting brackets.
- e. Place AILTECH 445 on the switchable rack chassis.
- f. Align tapped holes in mounting brackets with clearance slots in switchable rack chassis.

- g. Secure AILTECH 445 to switchable rack chassis by using No. 8-32 $\times$ 3/8 lockwashers and cap screws removed in step b.
- h. Insert plug-in modules into the slots provided.
- i. Connect RF cables (located at left of the slots) to the RF output jack for each plug-in module.
- j. Connect power cable to switchable rack.

NOTE

AILTECH 445 receives primary power through connection to the rack.

12-5. SWITCHABLE RACK OPERATION.

The band selector switch provides for applying the connection to each individual plug-in module and for programming the RF output to the connector on the switchable rack.

CAUTION

DO NOT SWITCH from one plug-in module to another with the primary power applied.

NOTE

Due to the length of cable connecting from the plug-in module through the relays, etc., to the front panel, there is an RF power drop. In some cases it may be necessary to connect directly to the RF plug-in module to obtain the maximum rated output.

TABLE 12-1. PARTS LIST FOR MODEL 1926 SWITCHABLE RACK.

Symbol	Figure	Description	Part No.	Vendor
B701	-	Fan, Muffin, Venturi		82877
B702	-	Fan, Muffin, Venturi		82877
F701	-	Fuse, Slo-Blo	3AG-5AMP	Com1
J705	-	Receptacle	57-40240	02660
J717	-	Receptacle, Male	160-5	02660
J718	-	Receptacle, Female	160-4	02660
J720	-	Connector, Bulkhead Type N	UG-1187/U	Com1
K701	-	Relay	GHB2C115VAC	82768
K702	-	Relay, Coaxial	360-11898-22	02660
P302*	-	Connector, Type N	UG536B/U	Com1
P701	-	Connector, Plug	57-20240	02660
P702	-	Receptacle	57-10240	02660
P703	-	Receptacle	57-10240	02660
P704	-	Receptacle	57-10240	02660
P705	-	Plug	57-30240	02660
P714	-	Connector, Plug, BNC	31-320	02660
P718	-	Plug, W/Cable Clamp	160-9	02660
P719	-	Receptacle, W/Cable Clamp	160-8	02660
S701	-	Switch	270244-DH8C	87034
S702	-	Switch, DPST	7561K4	15605
XF701	-	Fuse Holder	342004	75915

*Three connectors are used to mate with jack J302 on the plug-in modules.

TABLE 12-2. PARTS LIST FOR MODEL 1927 SWITCHABLE RACK.

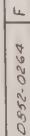
Symbol	Figure	Description	Part No.	Vendor
B801	-	Fan, Muffin, Venturi		82877
B802	-	Fan, Muffin, Venturi		82877
B803	-	Fan, Muffin, Venturi		82877
B804	-	Fan, Muffin, Venturi		82877
F801	-	Fuse, Slo-Blo	3AG-5AMP	Com'1
J801	-	Connector, Plug, 24-Pin	57-40240	02660
J822	-	Connector, Bulkhead, Type N	UG-1187/U	Com'1
J826	-	Receptacle, Female	160-4	02660
J827	-	Receptacle, Male	160-5	02660
K801	-	Relay	GHB2C11VAC	82768
K802	-	Relay, Coaxial	360-11898-22	02660
K803	-	Relay, Coaxial	318-10407-8	02660
K804	-	Relay, Coaxial	360-11898-22	02660
P302*	-	Connector, Type N	UG536B/U	Com'1
P701	-	Connector, Plug, 24-Pin	57-20240	02660
P705	-	Receptacle, 24-Pin	57-30240	02660
P802	-	Receptacle, 24-Pin	57-10240	02660
P803	-	Receptacle, 24-Pin	57-10240	02660
P804	-	Receptacle, 24-Pin	57-10240	02660
P805	-	Receptacle, 24-Pin	57-10240	02660
P806	-	Receptacle, 24-Pin	57-12040	02660
P807	-	Receptacle, 24-Pin	57-12040	02660
P808	-	Connector, Plug BNC	31-320	02660
P809	-	Connector, Plug BNC	31-320	02660
P810	-	Connector, Plug BNC	31-320	02660
P811	-	Connector, Plug BNC	31-320	02660
P812	-	Connector, Plug BNC	31-320	02660
P813	-	Connector, Plug BNC	31-320	02660
P814	-	Connector, Plug BNC	31-320	02660
P815	-	Connector, Plug BNC	31-320	02660
P816	-	Connector, Plug BNC	31-320	02660
P817	-	Connector, Plug BNC	31-320	02660
P818	-	Connector, Plug BNC	31-320	02660
P826	-	Plug, With Cable Clamp	160-9	02660
P827	-	Receptacle, With Cable Clamp	160-8	02660
S801	-	Switch, Wafer	270244-DH8C	87034
S802	-	Switch, DPST	7561K4	15605
XF801	-	Fuse Holder	342004	75915

*Six connectors are used to mate with jack J302 on the plug-in modules.

APPENDIX

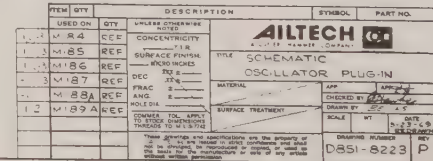
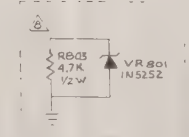
This Appendix contains schematic and wiring diagrams for the AILTECH 445 Power Oscillator. A blank space at the left of each drawing allows full view of the diagram (when unfolded) and any page of text, without removing the diagrams from the manual. This feature is especially useful when troubleshooting the equipment. The following diagrams are included.

<u>Figure No.</u>	<u>Title</u>
A-1	AILTECH 445 Schematic
A-2	Plug-in Module Schematic
A-3	Model 183 Plug-in Module Schematic
A-4	Time Delay Schematic
A-5	Fault Circuit Schematic
A-6	Model 1926 Switchable Rack Schematic and Wiring Diagram
A-7	Model 1927 Switchable Rack Schematic and Wiring Diagram



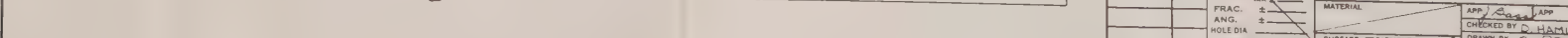
ITEM	QTY	DESCRIPTION	SYMBOL	PART NO.
USED ON	QTY.	UNLESS OTHERWISE SPECIFIED		
M445A		CONCENTRICITY 7 LR SURFACE FINISH — MICRO INCH X30 R DEC 11 R FRAC 8 ANG. 8 HOLE DIA		
				
			TITLE SCHEMATIC, M445A	
			MATERIAL	APP. 7/5 APP. CHECKED BY DATE
			SURFACE TREATMENT	SCALE 1/2" = 1" DATE 3-3-72
		COVER, 100 LBS. 1/2" TENSILE STRENGTH THREADS TO WLT.		DRAWING NUMBER REV
		These drawings and specifications are the property of and are not to be used in whole or in part without the written consent of the manufacturer or user. It is the responsibility of the user to obtain the necessary permits and approvals for the use of this drawing.		
			D852-0264	

D851-8223	P
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- NOTES :

FIGURE A-2



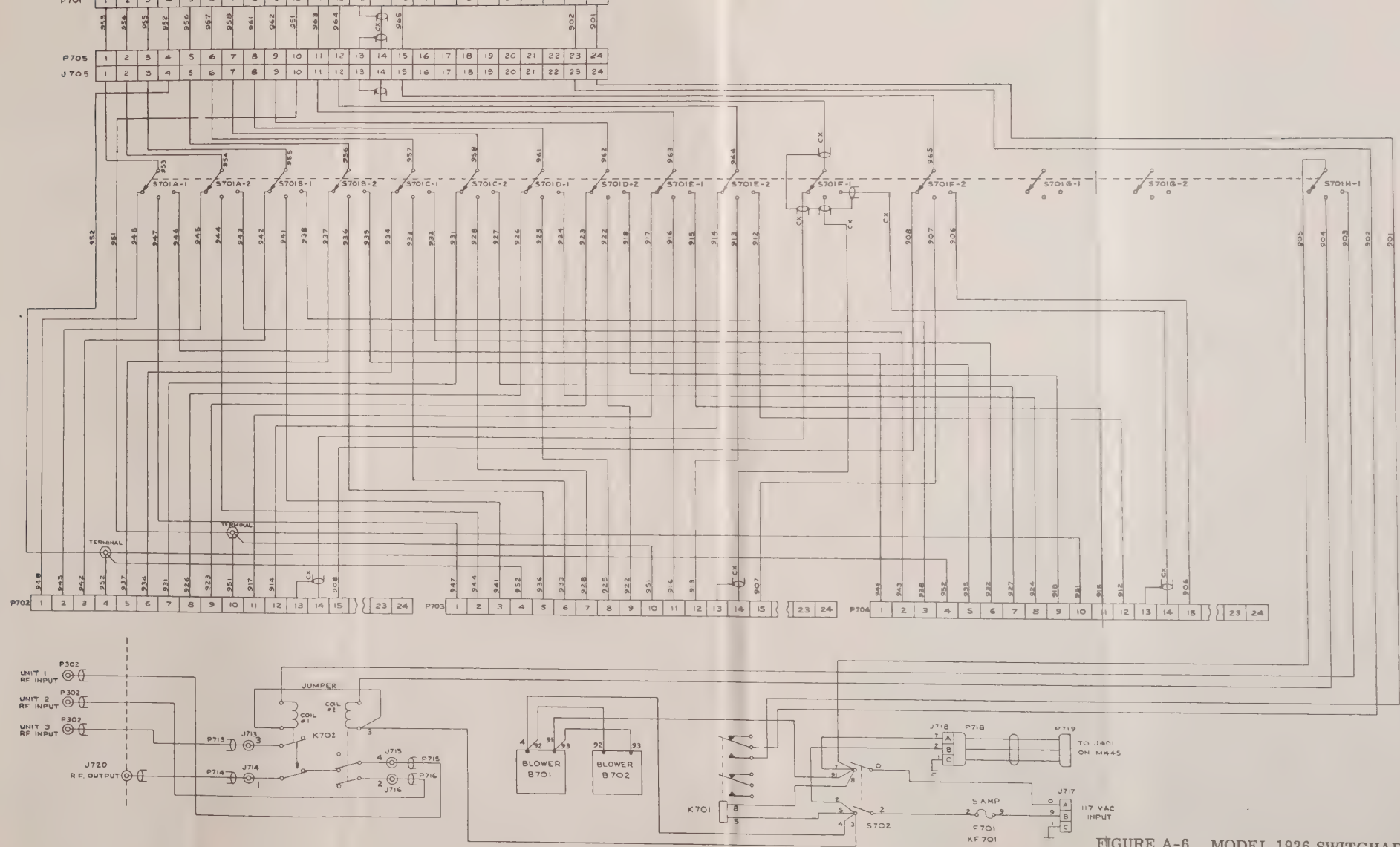
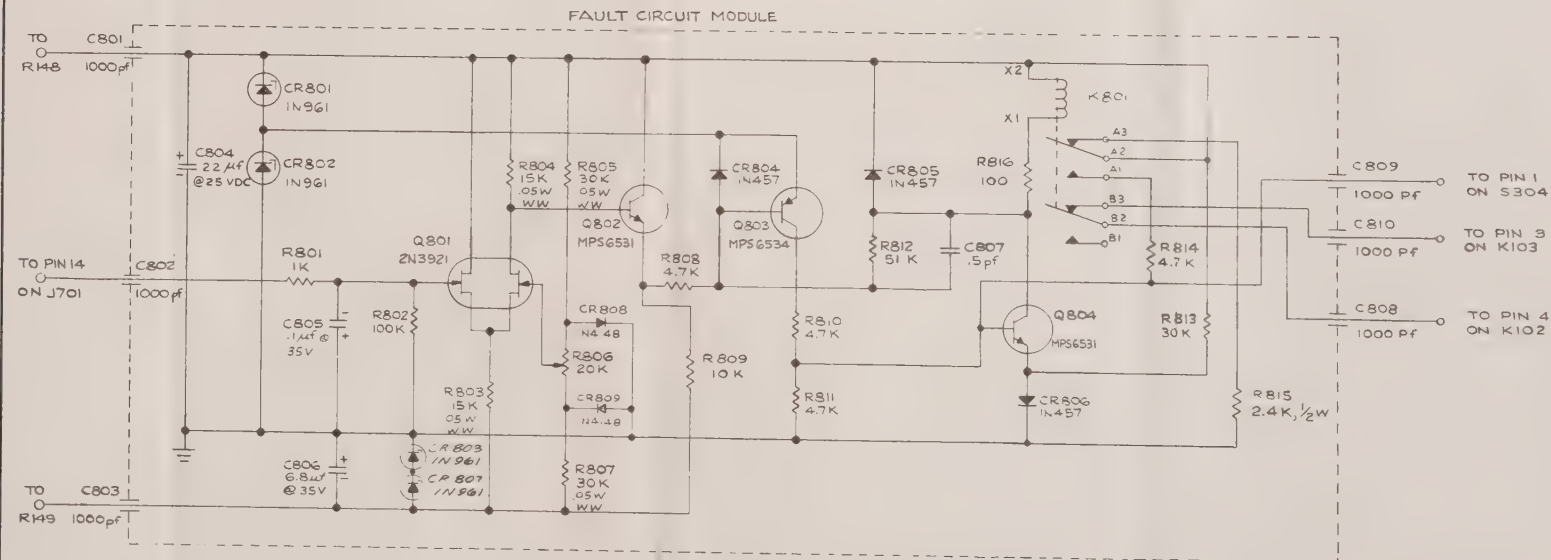


FIGURE A-6. MODEL 1926 SWITCHABLE RACK SCHEMATIC AND WIRING DIAGRAM

LET	ECO	REVISION DESCRIPTION	BY	DATE	APP
A	5358	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
B	6175	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
C	6060	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
D	6109	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
E	6126	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
F	6128	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	
G	7235	1.4.4 L. ADD HERE @ 20V	CA	7/1/67	



LAST SYMBOL USED

C 810
R 816
CR 809
Q 804
K 801

1. ALL RESISTOR 1/4W, 5%
NOTE: UNLESS OTHERWISE SPECIFIED

ITEM	QTY.	DESCRIPTION	SYMBOL	PART NO.
USED ON	QTY.	UNLESS OTHERWISE NOTED		
M445-2	REF	CONCENTRICITY		
M445	REF	SURFACE FINISH		
		DEC.		
		FRACTION		
		ANG.		
		HOLE DIA.		
		COMMON TO APPLY TO STOCK DIMENSIONS		
		THREADS TO MIL-S-7712		
		THREAT TREATMENT		
		SCALE		
		WT.		
		DATE		
		DRAWING NUMBER		
		REV		

C851-8442 G

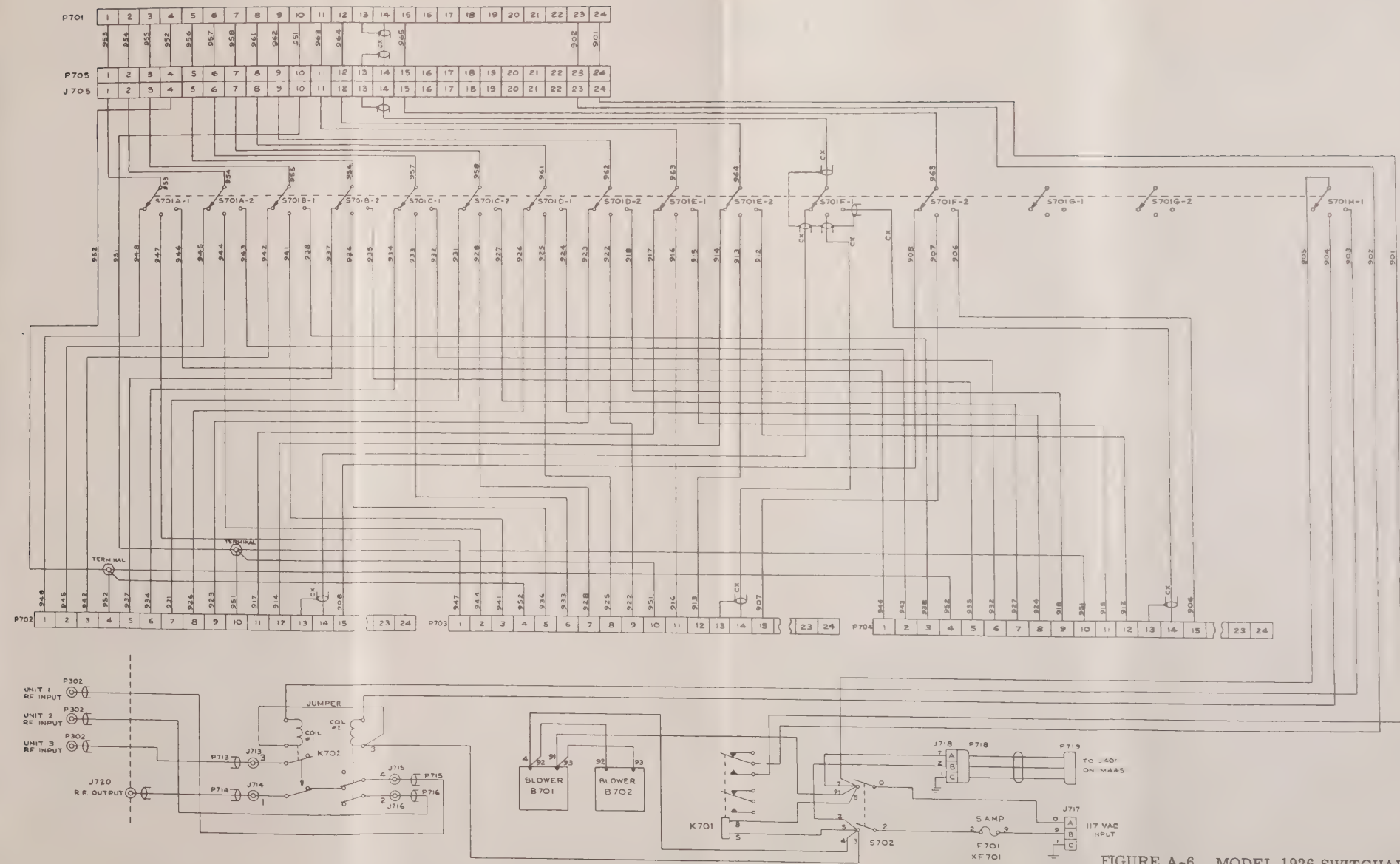


FIGURE A-6. MODEL 1926 SWITCHABLE RACK SCHEMATIC AND WIRING DIAGRAM

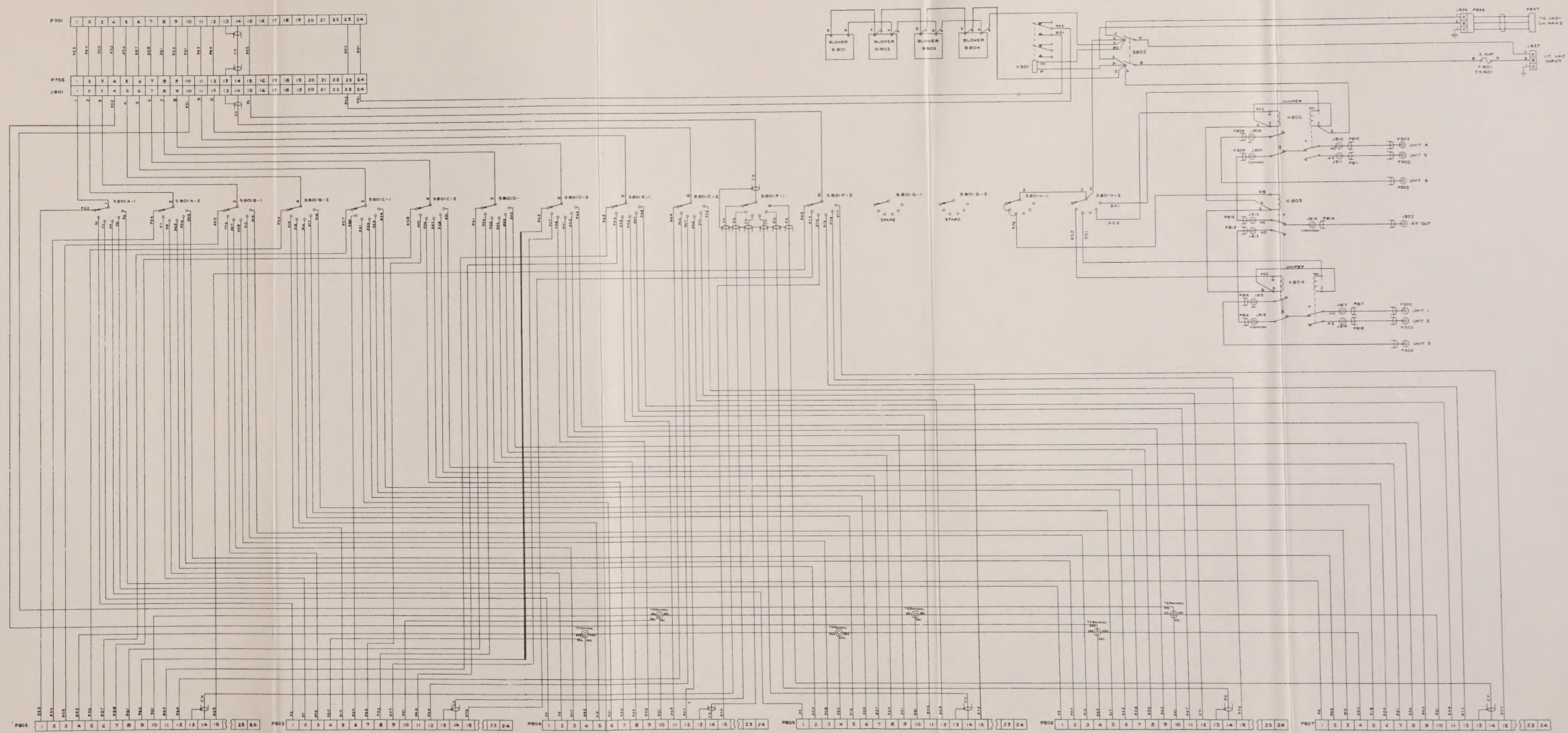


FIGURE A-7. MODEL 1927 SWITCHABLE RACK SCHEMATIC AND WIRING DIAGRAM

WARRANTY

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